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PRELIMINARY ISSUE

MODEL 2860

DATA AMPLIFIER

DANA™

Dana Laboratories Incorporated
Irvine, California 92664

Telephone (714) 833-1234
Teletype 910-595-1136

INSTRUCTION MANUAL

980242

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SECTION 1

GENERAL DESCRIPTION

1.1 INTRODUCTION

The Dana Model 2860 is a passive-guard differential amplifier with low noise at gains up to 2500, high level of common mode rejection, and fast settling time. Full-scale output is ±10 volts and ±100 milliamperes.

The Model 2860 features the advantages of direct-coupled amplifiers (linearity, low zero drift, low noise) with the 300-volt common mode operating capability that is characteristic of modulation-coupled amplifiers.

A front-panel bandwidth control allows the output to be set at any one of five selected bandwidths: 10Hz, 100Hz, 1kHz, 10kHz and wideband. The wideband 3dB point is 50kHz.

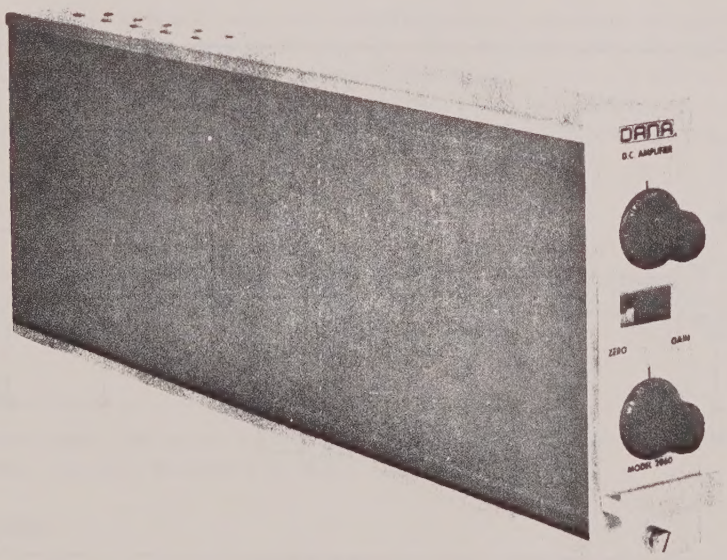


Figure 1.1 - Model 2860 Data Amplifier

The input, output, and power supply of the Model 2860 contain RF interference suppression from external RF noise. The Model 2860 provides almost complete isolation between the input leads and output common. If desired, the Model 2860 may also be used as a single ended unit, inverting or non-inverting, in applications in which either the source or the load is isolated from the ground. The common-mode rejection is 120dB, dc to 60 Hz.

Circuits within the amplifier prevent damage from short circuits and from fault voltages up to 30 volts normal mode.

System noise contributed by the amplifier circuitry is exceptionally low. The noise referred to the input (RTI) at a gain of 1000 is less than 5 microvolts rms in full bandwidth and less than 1 microvolt, peak-to-peak, in a 10Hz bandwidth.

1.2 OPERATIONAL DESCRIPTION

A block diagram of the Model 2860 is shown in Figure 1.2. The Preamplifier amplifies the normal mode signal. The amplified signal is modulated and applied to the isolation transformer, demodulated, and further amplified by the Output Amplifier. The common mode potential (E_{CM}) appears between the transformer shields. The input guard or shield surrounds the Preamplifier as well as the input leads. When the guard is referenced to the common mode potential, the

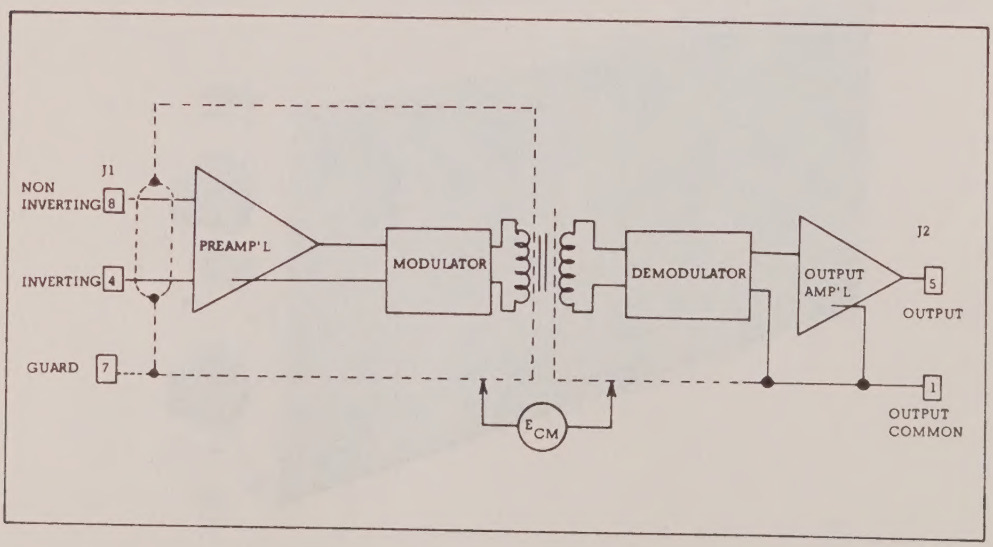


Figure 1.2 - Block Diagram, Model 2860

common mode potential is isolated from the preamplifier achieving the high common mode rejection required for data amplifiers. The passive guard or passive shield can reject a greater magnitude of common-mode voltage than the active-guard amplifiers and is characterized by constant common mode rejection - not affected by gain setting.

The Output Amplifier contains an operational amplifier and an active-admittance amplifier. The output voltage of the Output Amplifier is ±10 volts across a 100 ohm load.

Capacitors in the active-admittance filter are switched with each position of the BANDWIDTH switch to set the upper limit of each bandwidth.

Precision resistors in the Preamplifier are switched with each position of the GAIN switch to set the gain of the amplifier. A vernier extends each range equal to 2-1/2 times the nominal gain setting.

A more detailed description of the circuits of the Model 2860 is given in Section 4 - Circuit Description.

1.3 GAIN OPTIONS

Two gain options are available and must be specified when ordering the amplifier. They are designated as gain options V4 and V5. The Models 2860 V4 and 2860 V5 are especially suited in applications where low-level, millivolt signals are to be amplified to voltage levels for accurate recording or measuring and in applications where common mode potentials are greater than 10 volts dc or peak ac.

1.3.1 Option V4

The V4 option provides gain steps of 1, 2, 5, 10, 20, 50, 100, 200, 500, and 1000. A vernier multiplier extends each gain by a factor of 2.5:1. Gain accuracy of the V4 option is ±0.1%.

1.3.2 Option V5

The V5 option provides the same gain steps and vernier multiplier as the V4 option. However, the gain accuracy of the V5 option is ±0.01%.

1.4 SPECIFICATIONS

Specifications are listed in Table 1.1.

1.5 AMPLIFIER ENCLOSURES

The 2808 Enclosure accommodates eight amplifiers. The enclosure is 7 inches in height with a depth of 22 inches and a width, including flanges, of 19 inches.

Table 1.1 - Specifications

DANA MODEL 2860 SPECIFICATIONS	All specifications apply for 0 to 1000 ohm source, in any unbalance.
Gain	
Range	1 to 2500 with 2.5:1 vernier
Steps	1, 2, 5, 10, 20, 50, 100, 200, 500, 1000
Accuracy	±0.01% V5 option; ±0.1% V4 option
Resolution	±0.01% (±0.03% worst case)
Stability (at gain setting and constant temperature)	±0.01% (200 hrs)
Temperature coefficient	±0.005%/°C
Output (no damage for sustained short circuit)	
Full scale voltage	±10 V
Voltage overrange, nominal	20%
Full scale load current	±100 mA
Maximum short circuit current	±150 mA (adjustable to ±60 mA)
Impedance	0.1 ohm in series with 30μH
Capacitive load, without instability	Infinite
Capability	Full scale voltage and current to 50 kHz
Frequency Response (at full output)	
Wideband	
dc to 100 Hz	±0.01%
Minimum 3 dB frequency	50 kHz
Variband	
Filter characteristics	3 pole Bessel
Switch selectable cutoff frequencies (f_{CO}) of	10 Hz, 100 Hz, 1 kHz, 10 kHz, wideband
Attenuation at selected f_{CO}	−3 dB ±1 dB
Attenuation above selected f_{CO}	−60 dB/decade
Linearity	
dc to 2 kHz	±0.01%
Common Mode	
Rejection ratio at dc	140 dB
Rejection ratio dc to 60 Hz	120 dB
Operating voltage dc to 60 Hz	300 V dc or peak ac
Fault voltage dc to 60 Hz without damage	300 V dc or peak ac
Noise	
Full bandwidth	3μV rms RTI + 2 mV rms RTO
10 kHz bandwidth	1μV rms RTI + 1 mV rms RTO
10 Hz bandwidth	1 mV peak to peak RTO, for any gain
Input Impedance	
Normal mode	10,000 MΩ, parallel with 0.001 μF
Zero Stability	
At constant temperature (after 30 minute warm-up)	±0.02% (200 hrs)
Temperature coefficient	(±0.002% RTO ±1 μV RTI)/°C and ±0.5 nA RTI/°C
Step Function Response	
Settles to final value ±0.01% of full scale in	$175\ \mu\text{sec} + \frac{1.6\ \text{sec}}{f_{CO}}$
Overload Recovery	
Settles to final value ±0.01% of full scale for 5 times full scale input for gains of 5 to 2500 or 10 V for gains of 1 to 5 in	$400\ \mu\text{sec} + \frac{1.6\ \text{sec}}{f_{CO}}$
No damage for 30 V dc or peak ac input on any gain	
Temperature Range	
Operating	0°C to +50°C
Storage	−20°C to +75°C
Power Requirement	
Domestic	105 to 125 V rms, 50 to 400 Hz, 10 watts
Export Option 1	200 to 240 V rms, 50 to 400 Hz, 10 watts
Export Option 2	215 to 265 V rms, 50 to 400 Hz, 10 watts
Export Option 3	90 to 110 V rms, 50 to 400 Hz, 10 watts
Enclosure	
Model	2808-1 or 2808-2
Capacity	8 amplifiers fit in a standard 7 inch by 19 inch panel space
Bench Operation	
Model	2801 single unit adapter

The basic model is modified by a "dash" number which specifies the type of wiring.

The 2808 Enclosure accommodates all of the Dana Series 2800 Amplifiers. The amplifiers are interchangeable in the enclosure without alteration of the input and output cables.

The -1 Enclosure contains connectors to accommodate system wiring. Fusing and AC wiring are factory wired. An outline drawing (452402) is included in Section 6, "Drawings and Parts Lists".

The -2 Enclosure is fully wired. The inputs and outputs are accessible through connectors mounted on the rear panel. An outline drawing (452403) is included in Section 6, "Drawings and Parts Lists".

The model 2802-2 enclosure accomodates two 2800 series amplifiers. All 2800 series amplifiers are interchangeable in the enclosure without alteration of the input and output cables.

The 2802-2 can be adapted for bench use or for rack mount use. Dimensions of the enclosure are, height 3.5 inches, depth 20 inches, width 17 inches. Inputs and outputs are accessible through connectors mounted on the rear panel. An outline drawing (402619 page 1 of 3) is included in section 7, Drawings and Parts Lists.

Wiring instructions for each type enclosure are included in Section 2, "Installation".

1.6 AMPLIFIER ACCESSORIES

An Adapter Set Model 2801 (Dana part number 402468) and an Amplifier Support Bracket (Dana part number 452411) are used when the amplifier is operated on the bench. The Adapter Set (item 1 in Figure 1.3) contains input leads, output leads, and the power cord. The Amplifier Support Bracket (item 2 in Figure 1.3) mounts to the amplifier to support the amplifier in an upright position.

Figure 1.3 - Amplifier Accessories

SECTION 2

INSTALLATION AND INITIAL CHECKOUT

2.1 UNPACKING AND INSPECTION

The Dana Amplifier is shipped in a special reusable shipping package, designed to protect the instrument from excessive shock and vibration. Examine the package for signs of external damage before removing the unit. If external damage is present, notify the carrier before proceeding. Next, examine the outside of the amplifier for any evidence of damage due to excessive shock, vibration, water leakage, etc.

If the unit appears in perfect condition, proceed with the installation. However, if there is any apparent damage, communicate with the carrier for instructions.

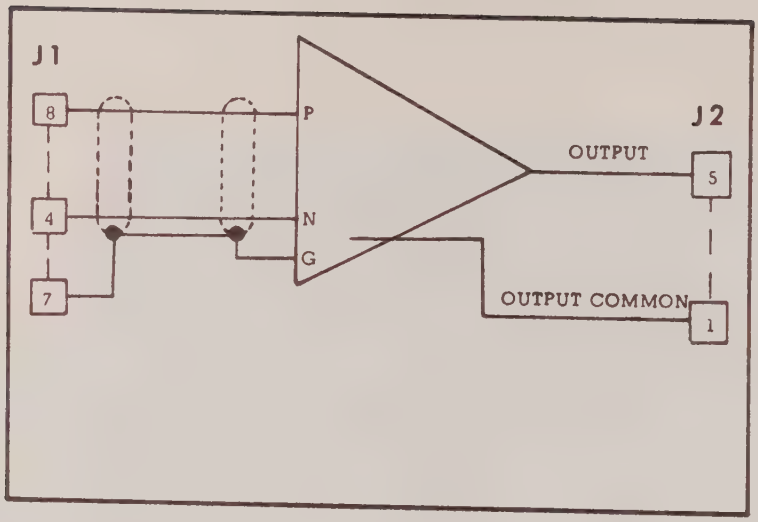
2.2 POWER REQUIREMENTS

Dana Amplifiers, manufactured for domestic use, operate on 115 volts (±10 volts), 50 to 400 Hz. Units manufactured for export operate on 210 to 250 volts, 50 to 400 Hz. Power required is eight watts.

> NOTE
>
> If the Amplifier has been stored for a prolonged period (5 or 6 months) without use, it is recommended that it be operated with a variable transformer, such as a Variac, at one-half line voltage for about two hours before gradually applying full power. This is done to "reform" the electrolytic capacitors in the amplifier and reduce the chance of capacitor failure.

2.3 INPUT - OUTPUT CONNECTIONS

Input and output connections to the amplifier are through an eight pin connector (J1) at the rear of the amplifier (see Figure 2.1). External connections are brought in through a mating connector. When the Dana enclosures are used, the mating connector for each amplifier is mounted on the inside back panel of the enclosure; each amplifier plugs into its corresponding connectors. When amplifiers are used singly, a single unit adapter set is normally used. The adapter set (Dana part number 402468) includes the mating connector, power cord, and clip leads for input and output signal connections.



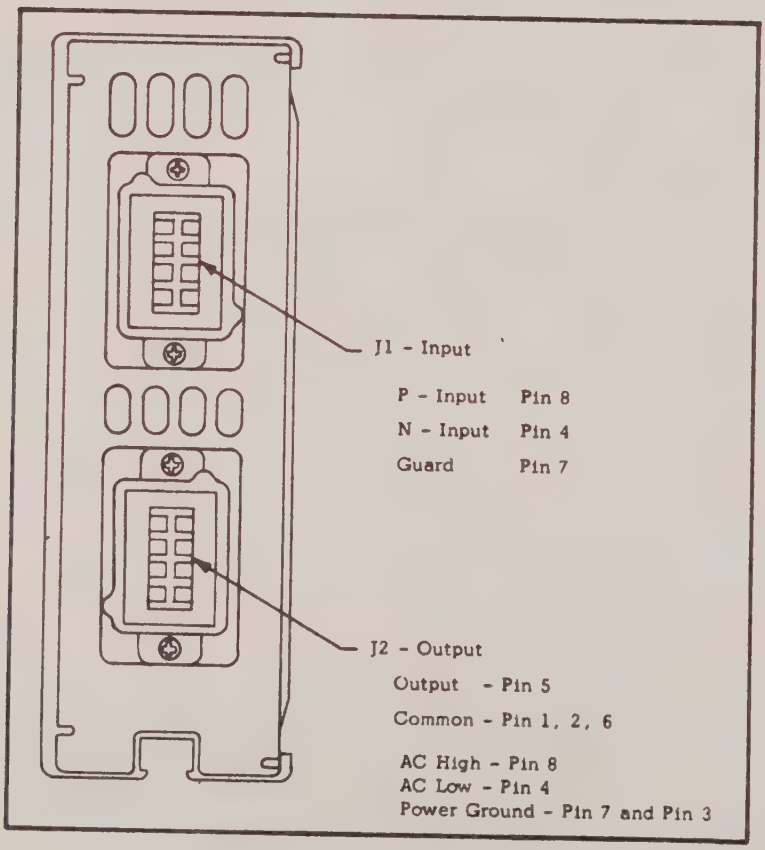

J1 - Input
P - Input Pin 8
N - Input Pin 4
Guard Pin 7
J2 - Output
Output - Pin 5
Common - Pin 1, 2, 6
AC High - Pin 8
AC Low - Pin 4
Power Ground - Pin 7 and Pin 3

Figure 2.1 - Input/Output Connections

When the 2808-1 Enclosure is used, external connections are made directly to the solder side of the enclosure mounted connector for each amplifier. Access to connectors is gained by removing four screws holding the rear panel and allowing the top of the rear panel to drop away from the enclosure. External leads are routed through the grommet holes and soldered to the connectors.

In the 2808-2 Enclosure, conventional cable connectors are mounted on the rear panel. Connections are made by wiring to the mating connector. All pin connections are identified in Figure 2.2.

2.3.2 Power

When the Amplifier is to be operated within the 2808-1 or 2808-2 Enclosure, power is prewired and a three-wire line cord is supplied. When using the cord set, power and input/output connections are prewired. The power cord is connected to P2 of the cord set.

The ground wire of the power cord connects to the internal power supply shield of the amplifiers.

2.3.3 Input/Output Signals

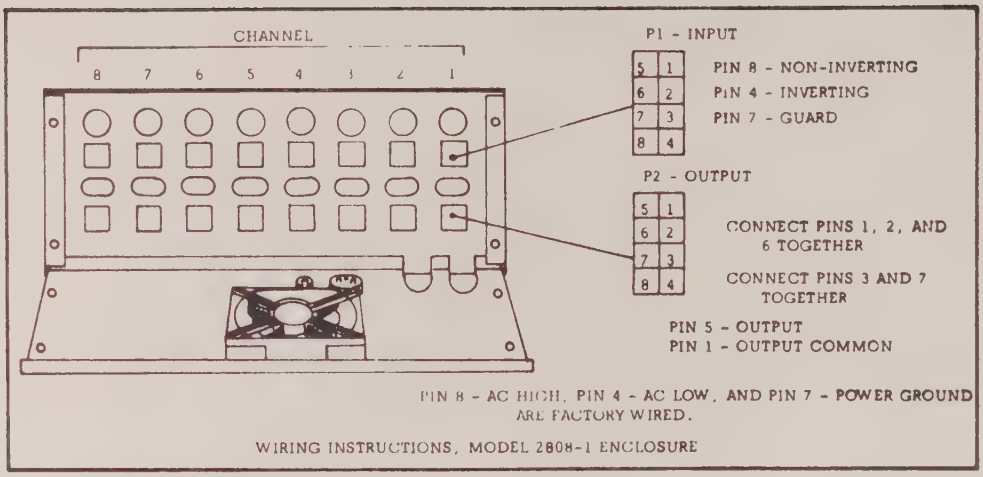
Input wiring configurations are extremely important in minimizing common mode voltages. The guard lead should be connected as close as possible to the signal source. Input and output connections are shown in Figure 2.2.

For permanent installations, low thermal solder (70% cadmium, 30% tin) should be used for all input connections to reduce thermalcouple errors. For temporary or test setups, screw terminals or clips having low resistance may be used, taking suitable care to minimize thermal emf's (a few microvolts can be significant on high gain ranges.

Since P and N inputs to the amplifier are symmetrical (approximately equal impedance to output common), either lead may be connected to either side of the signal source. For phasing purposes, if P is positive with respect to N, the output is positive with respect to output common.

Input leads should be two-conductor in an insulated shielded cable (Belden #8451-500, or equivalent). The shield must be soldered to the guard pin connection (pin 7 of J1 when a -1 Enclosure is used; pin B of the signal input connector for a -2 Enclosure). The unshielded portion of the leads must be kept as short as possible.

A single-conductor shielded cable is recommended for output leads. If two-conductor is used, connect one lead and shield together at either end or both ends. Solder the shield to Output Common (pin 1 of J2 for -1 enclosures; see Figure 2.1 for -2 enclosures). The enclosure chassis is connected to ground by the power cable. The lead from the output common terminal of the amplifier should be connected directly to the input common or ground of the output device.


CHANNEL
8 7 6 5 4 3 2 1
P1 - INPUT
5 1
6 2
7 3
8 4
PIN 8 - NON-INVERTING
PIN 4 - INVERTING
PIN 7 - GUARD
P2 - OUTPUT
5 1
6 2
7 3
8 4
CONNECT PINS 1, 2, AND 6 TOGETHER
CONNECT PINS 3 AND 7 TOGETHER
PIN 5 - OUTPUT
PIN 1 - OUTPUT COMMON
PIN 8 - AC HIGH, PIN 4 - AC LOW, AND PIN 7 - POWER GROUND ARE FACTORY WIRED.
WIRING INSTRUCTIONS, MODEL 2808-1 ENCLOSURE

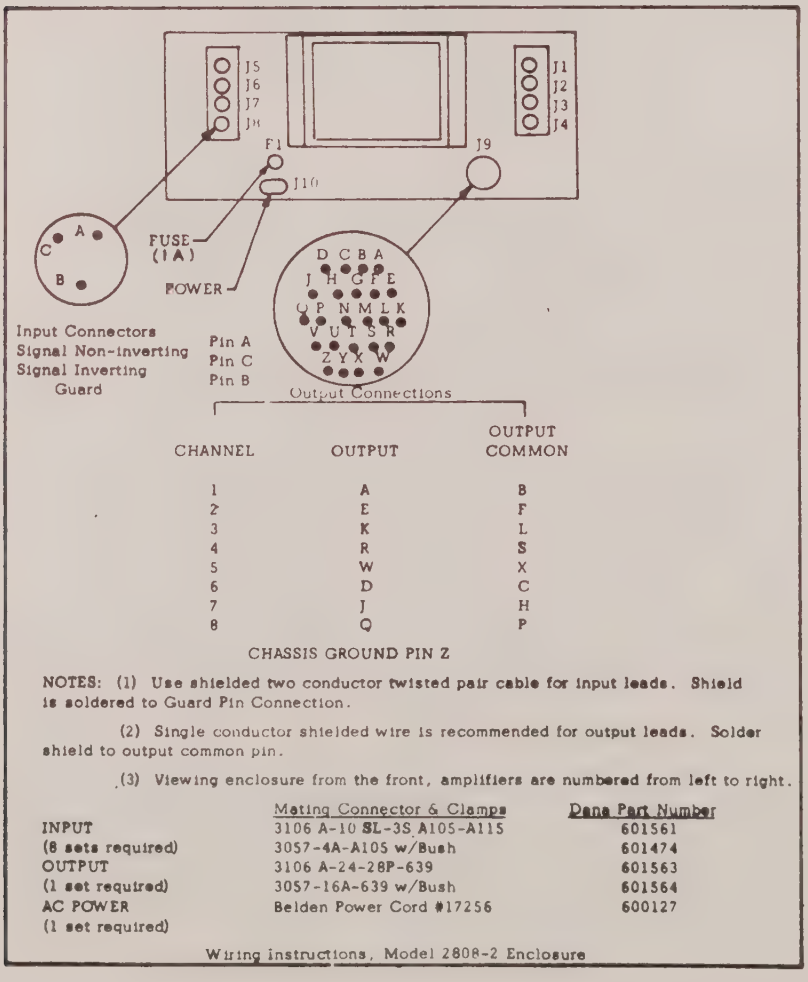
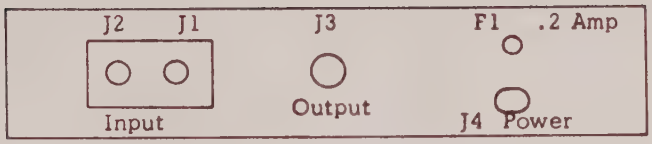


Figure 2.2 - Enclosure Wiring



Input Connectors

Pin A	Signal Non-Inverting
Pin B	Guard
Pin C	Signal Inverting

Output Connector

Pin A	Channel 2 Output
Pin C	Output Common Channel 2
Pin D	Connector Shell
Pin E	Output Common Channel 1
Pin G	Channel 1 Output

Figure 2-3 2802-2 Enclosure Wiring

2.4 INITIAL CHECKOUT PROCEDURES

The amplifier is accurately adjusted and carefully inspected at the factory. The following tests check basic characteristics of the amplifier to verify proper operation upon delivery. The type of damage that can be expected in shipment tends to produce gross malfunctions rather than minor changes in sensitive characteristics. More complete and precise tests and calibration procedures are included in Section 5, "Calibration".

Only three items of test equipment are required to perform initial checkout of the amplifier:

- Audio Oscillator
- Voltage Divider/Attenuator
- Oscilloscope

Standard laboratory-type instruments from any manufacturer may be used.

2.4.1 Gain Checkout

1. Connect the common or ground terminals of each item of test equipment to a single point and to the amplifier output common (pin 1 of J2). Connect this point to ground. Make all measurements relative to this point (see Figure 2.4).

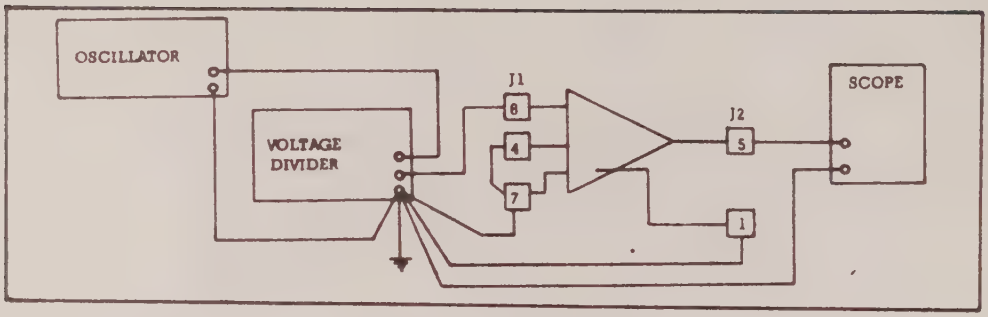


Figure 2.4 - Gain Test Setup

2. Set voltage divider to minimum output — zero, if possible.

3. Apply power to amplifier. Observe amplifier output on oscilloscope. It should be within a few millivolts of ground and change only very slightly as the amplifier GAIN switch is rotated.

4. Set the VERNIER gain adjustment fully counterclockwise.

5. Set the GAIN selector switch at the highest gain position.

6. Remove scope lead from amplifier output and connect scope to the oscillator output. Adjust oscillator for 20 volts, peak-to-peak, at 100 Hz.

7. Set voltage divider to the reciprocal of the maximum gain setting, 1/K. (For example, at maximum gain of 1000, set divider to 0.001.)

8. Return the scope to the amplifier output, pin 5 of J2. The scope should now indicate approximately the same value, 20 volts peak-to-peak, observed at the oscillator output. (The term "approximately" is used because of the limited capability of an oscilloscope to compare two magnitudes accurately.)

9. Verify that there is no obvious noise or other unexplained distortions on the oscilloscope trace.

2.4.2 Frequency Response Checkout

1. Use test setup exactly as connected for Gain checkout. Set amplifier GAIN control at maximum; vernier adjustment to minimum. Connect scope to oscillator output; set oscillator frequency to 50 kHz. Set the BANDWIDTH switch to the WB(wideband) position.

2. Set oscillator output at 20 volts, peak-to-peak (on scope).

3. Remove scope lead from oscillator and connect to amplifier output pin 5 of J2. Adjust voltage divider for amplifier output amplitude equal to that observed in step 2.

4. Compare voltage divider setting with zero — or minimum output position. The difference should be no less than 3dB, or approximately 30%.

2.4.3 Common Mode Rejection

1. Short the amplifier input leads and the input guard lead (pins 8, 4, and 7 of J1). Connect these leads to the high side of a signal generator.

2. Connect oscilloscope to amplifier output (pin 5 of J2).

3. Set oscillator output to 20 volts, peak-to-peak, at 60 Hz.

4. Set amplifier GAIN switch to 1000.

5. Observe amplifier output on scope. The output due to common mode is normally not detectable above the wideband noise of the amplifier. Common mode rejection can be calculated as follows:

$$CMR = \frac{20 \text{ Volts (P-P)} \times K}{\text{Output Voltage (P-P)}}$$

SECTION 3

OPERATION

3.1 CONTROLS

3.1.1 Gain Selector Switch

The GAIN switch is rotated to select the desired gain of the amplifier. One of ten gain positions may be selected. The selected gain is inscribed on the knob of the gain selector switch.

3.1.2 Bandwidth Switch

The BANDWIDTH switch allows selection of the amplifier bandwidth. It is calibrated in kilohertz and has the following positions:

Switch Position	Bandwidth
0.01	DC to 10Hz
0.1	DC to 100Hz
1.0	DC to 1000Hz
10.0	DC to 10kHz
Wideband (WB)	Full Bandwidth

Model 2860

3.2 OPERATIONAL ADJUSTMENTS

3.2.1 ZERO Adjustment

ZERO is a screwdriver adjustment on the front panel of the amplifier. It is used to set the output voltage to zero volts with no input. It is adjusted in the following manner:

1. Apply power to the amplifier and any adjoining heat-producing equipment and allow amplifier to stabilize (approximately 30 minutes).
2. Set GAIN selector switch to lowest gain position.
3. Return the input P(J1-8) and N(J1-4) leads to output common (J2-1).
4. Connect voltmeter or scope to amplifier output (J2-5) and common (J2-1).

5. Adjust ZERO for zero amplifier output. Counterclockwise rotation corrects for a positive output; clockwise rotation corrects for a negative output.

3.2.2 GAIN Adjustment

This is a screwdriver adjustment which serves as a vernier adjustment of gain selected by the GAIN selector switch. The adjustment varies each gain position by a factor of 2.5:1 — providing continuous gain selection throughout all available ranges.

3.3 OPERATING PROCEDURES

After installation of the amplifier as described in Section 2, operation consists simply of selecting the appropriate gain. The amplifier is ready for use immediately with zero stability achieved within 30 minutes.

SECTION 4

CIRCUIT DESCRIPTION

4.1 INTRODUCTION

A block diagram of the Model 2860 amplifier is shown in Figure 4.1. The forward loop consists of the preamplifier, isolator, and output amplifier. The preamplifier amplifies the potential difference between the two inputs e_1, e_2. The output of the amplifier is proportional to the difference of the amplitudes. These signals are referred to as "normal mode signal" (also referred to as "difference" or differential signals). The potentials common to both inputs are referred to as "common mode potentials" and are physically isolated from the preamplifier by a mechanical enclosure.

The normal mode signals are defined as

$$\text{Normal Mode Signal} = e_2 - e_1$$

$$\text{Output } (E_o) = (e_2 - e_1) \text{ (Gain)}$$

In single ended operation, a signal is applied to e_2 while e_1 is common; therefore, the output is proportional to the amplitude of the one signal applied.

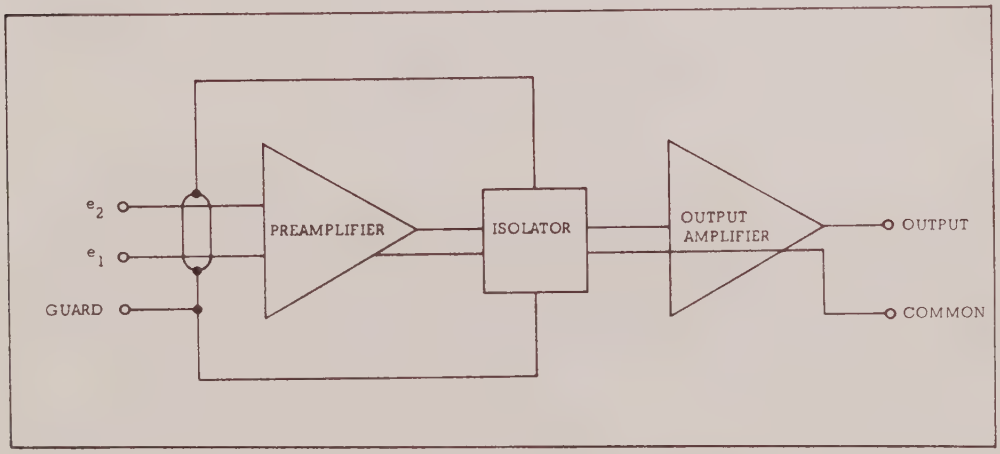


Figure 4.1 - Block Diagram, Model 2860 Amplifier

4.2 PREAMPLIFIER

The Preamplifier is shown in Figure 4.2. The normal mode signals are converted into current and applied to the isolator. The gain resistor (R_G) scales the input voltage such that the full scale current (i) to the isolator is 1 milliampere for all possible full scale input signals (10 millivolts to 10 volts). The required resistor R_G is switched into the circuit by the GAIN switch on the front panel. Values of R_G range from 10 ohms to 10,000 ohms according to the relation

$$R_G = \frac{e_2 - e_1}{1 \text{ milliampere}}$$

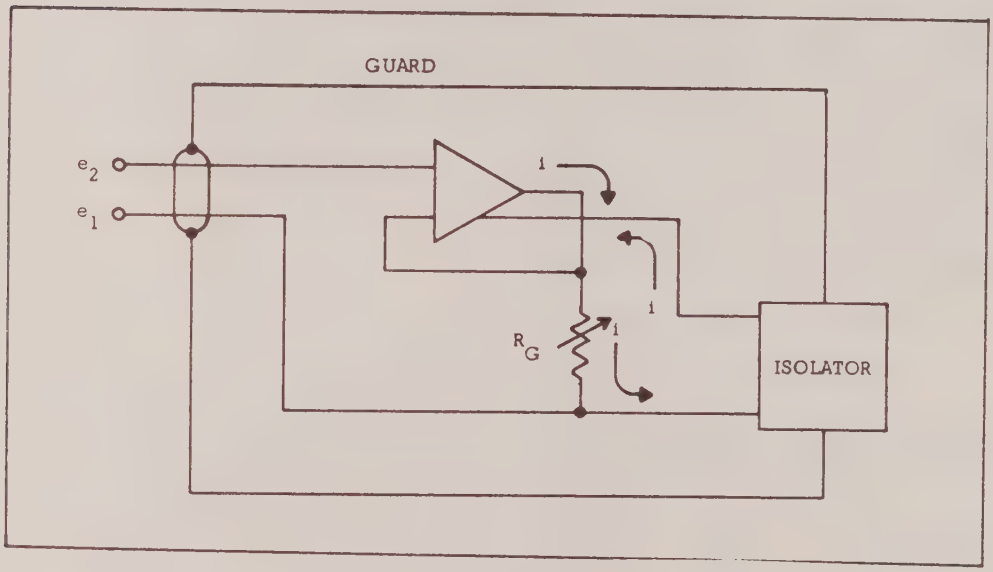


Figure 4.2 - Preamplifier

4.3 ISOLATOR

The Isolator contains a transformer, a modulator, and a demodulator as shown in Figure 4.3. The current enters the primary winding of the transformer from the preamplifier, is modulated, and coupled to the secondary winding of the transformer where it is demodulated in the demodulator section of the isolator. The modulator and demodulator are synchronized from the same source for the proper phasing of the signal. An astable multivibrator provides the switching source to the modulator switches and the demodulator switches as shown in Figure 4.4.

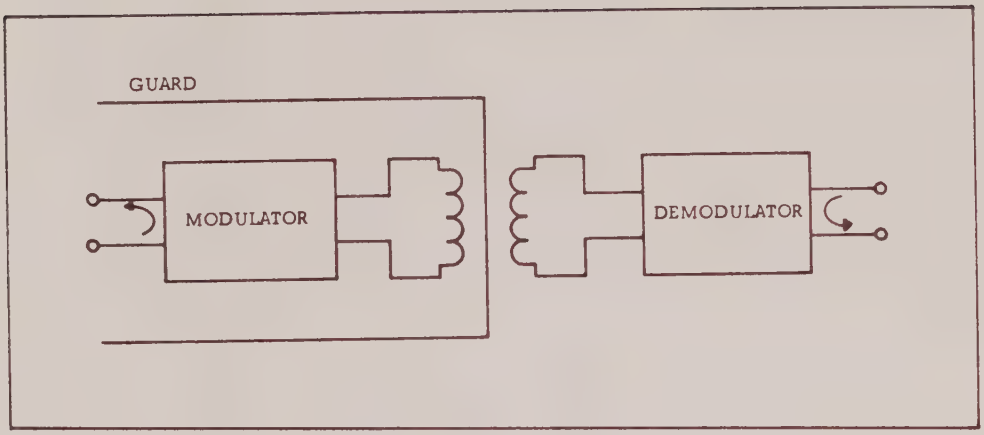


Figure 4.3 - Isolator

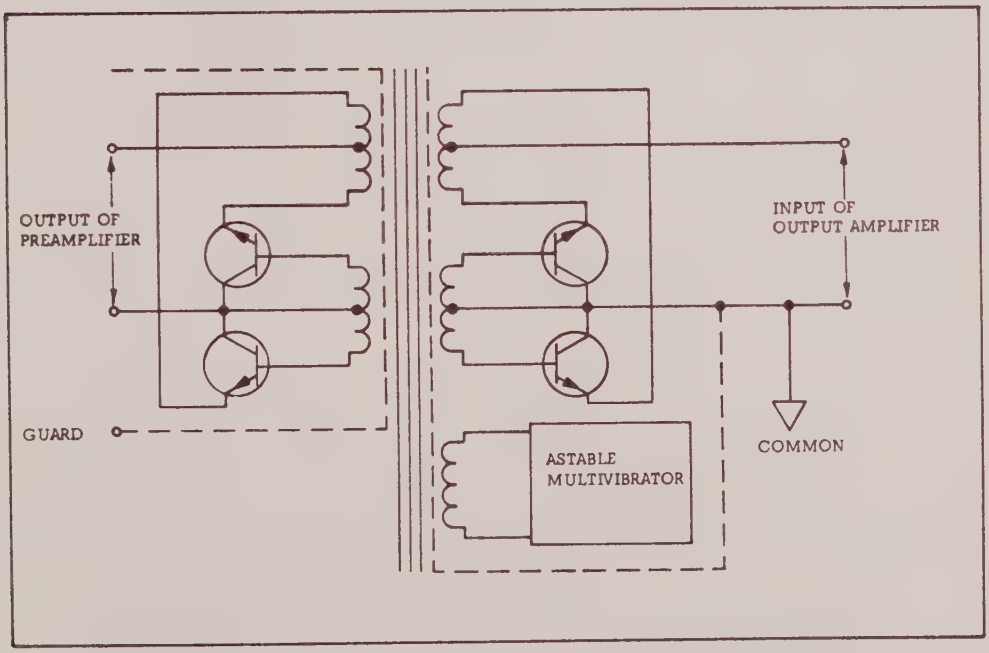


Figure 4.4 - Modulator and Demodulator

4.4 OUTPUT AMPLIFIER

The Output Amplifier (Figure 4.5) consists of an operational amplifier, active-admittance filter, and buffer amplifier. A negative feedback trim potentiometer is the vernier gain adjust for the amplifier. Current at the input is converted to voltage at the output. The active-admittance filter is a three pole Bessel filter consisting of a resistor R_1 and an active filter (Y) that attenuates the signal 3dB at the selected cutoff frequency (front panel BANDWIDTH control). Attenuation above the cutoff frequency is 18dB per octave, 60dB per decade. The buffer amplifier is a unity gain amplifier that provides $\pm$100 milliamperes to a load of 100 ohms.

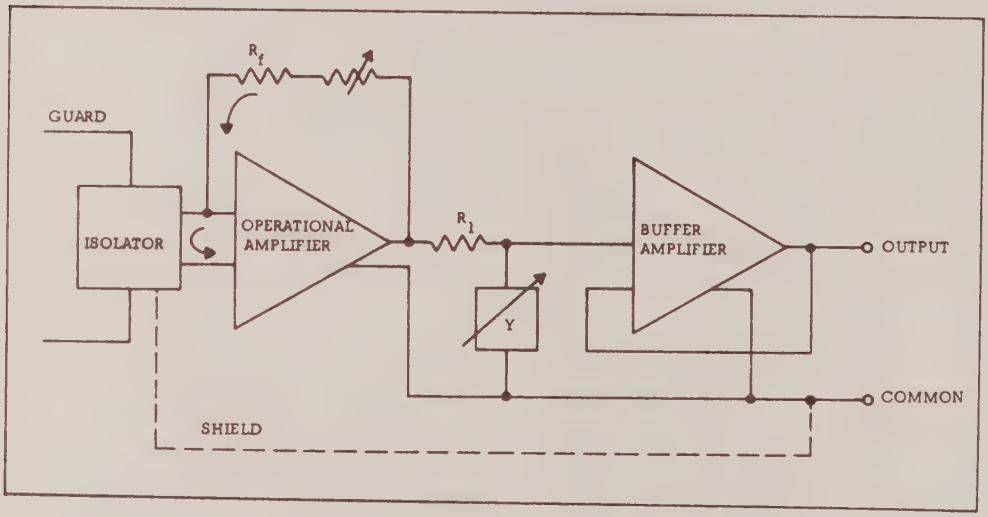


Figure 4.5 - Output Amplifier

SECTION 5

CALIBRATION

5.1 TEST EQUIPMENT

1. OSCILLOSCOPE - X-Y inputs; bandpass, DC - 500 kHz; calibrated deflection factors of 1 millivolt to 20 volts per centimeter accurate within 3%; input impedance, 1 megohm paralleled by less than 50pf.

2. OSCILLATOR - Frequency range, 5 Hz-500kHz; accuracy, ±2%; frequency response, ±1dB; adjustable output voltage, 160 milliwatts (10 volts) into 600 ohms rated load, 20 volts open circuit.

3. VACUUM TUBE VOLTMETER - Voltage range, 0.1 millivolt to 300 volts; dB range, -72 to +52dB; frequency range, 10 Hz to 1 MHz accurate within ±2% (50Hz - 500 kHz); input impedance, 10 megohms paralleled by less than 50pf.

4. ATTENUATOR - Attenuation to 120dB in 1dB steps; DC to 1 MHz accurate within ±dB; power capacity, 5 watts.

5. DC MILLIVOLTMETER (Optional)

6. Dana Adapter Set 2801 (P/N 402468).

5.2 CALIBRATION PROCEDURES

Certain performance characteristics should be checked periodically and internal adjustments made as required. These adjustments are detailed in paragraph 5-4 — Field Calibration.

The Calibration procedure in paragraph 5.5, Major Calibration, should be performed after repair of the instrument.

5.3 FIELD CALIBRATION

Physical location of the adjustable components is shown in Figure 5.1. The procedure below should be performed in the order listed.

> NOTE: Common mode potentials appear between the guard box and chassis; therefore, an insulated screwdriver or adjustment tool (J.F.D Adjustment Tool 5284) should be used to make the adjustments.

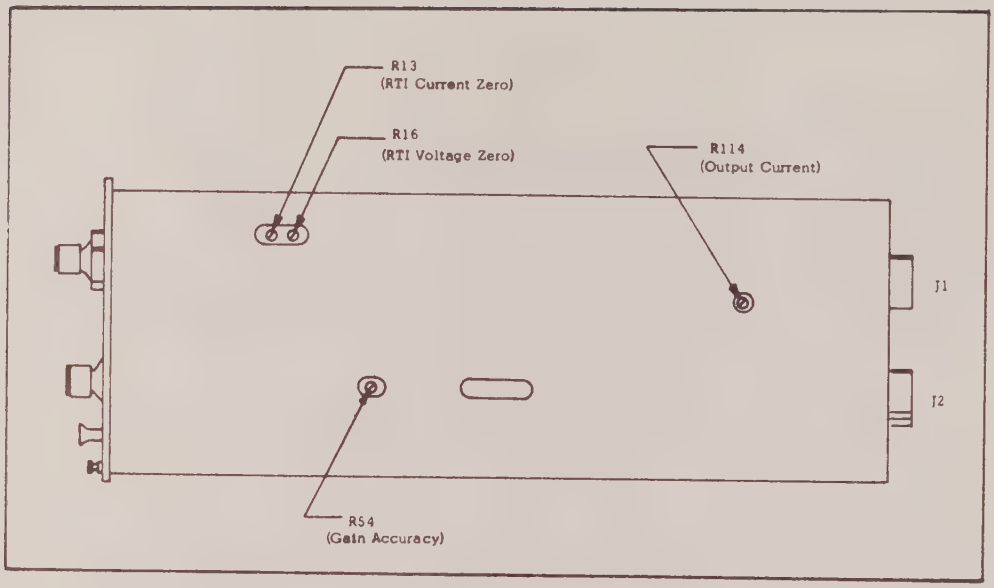


Figure 5.1 - Amplifier Adjustments, Physical Location

5.3.1 Referred to Input (RTI) Voltage Zero

In addition to the operational ZERO adjustment on the front panel, the amplifier is equipped with an internal zero adjustment (R16). Procedure for making the adjustment is as follows:

1. Connect amplifier inputs P(J1-8), N(J1-4), and guard (J1-7) together.

2. Connect an oscilloscope or millivoltmeter to output (J2-5) and common (J2-1).

3. Set the front panel GAIN vernier (R55) fully counterclockwise.

4. Set the GAIN switch to the gain of 1; adjust the front panel ZERO adjustment (R60) for minimum reading on the millivoltmeter. Record any residual offset.

5. Set the amplifier GAIN switch to the gain of 1000; adjust the internal collector zero adjustment (R16) for the same offset recorded in step 4.

6. Repeat steps 4 and 5 until the output remains the same on both the highest and lowest gain settings.

5.3.2 Referred to Input (RTI) Current Zero

This adjustment minimizes current flow through the input terminals. For most accurate adjustment, the following procedure should be performed after the RTI Voltage zero adjustment.

1. Set amplifier GAIN switch to the gain of 1000.
2. Connect input terminals P(J1-8), N(J1-4), and guard (J1-7) together.
3. Set the front panel GAIN vernier (R55) fully counterclockwise.
4. Connect oscilloscope to output (J2-5) and common (J2-1). Set vertical deflection to 1mV/cm. Record amplitude of offset voltage at output.
5. Disconnect P(J1-8) terminal from N(J1-4) and guard (J1-7), insert 1K resistor in series and reconnect to N(J1-4) and guard (J1-7).
6. Adjust R13, the base current zero control, for the same offset recorded in step 4.

5.3.3 Gain Accuracy Adjustment

The gain trim adjustment sets the gain accuracy of the amplifier. The gain accuracy for the V4 option is ±0.1%, the gain accuracy for the V5 option is ±0.01%.

1. Connect the test setup shown in Figure 5.2.

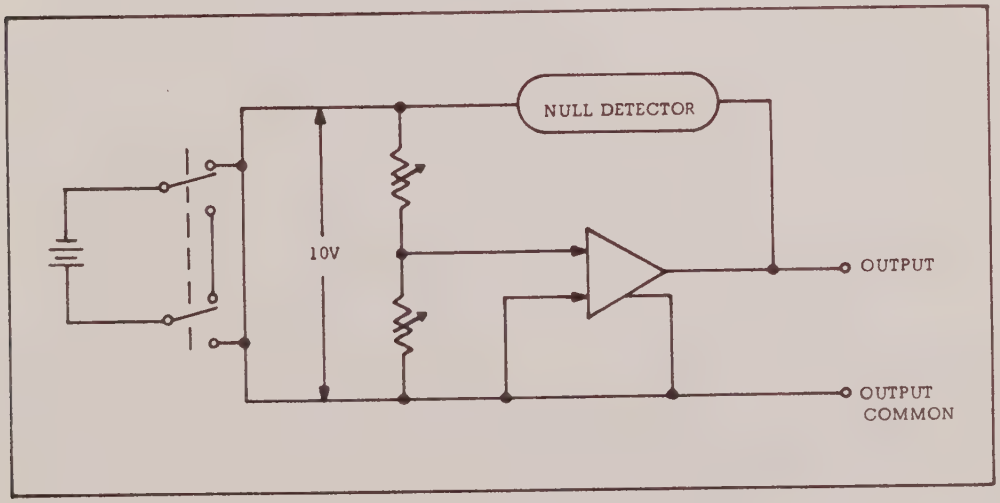


Figure 5.2 - Gain Accuracy Adjustment

2. Set the vernier gain adjustment on the front panel of the amplifier fully counterclockwise.

3. Set the GAIN selector switch of the amplifier to the gain of 100.

4. Set voltage divider* to the reciprocal of gain setting, 1/k. (For the gain of 100, set the voltage divider to 0.01).

5. Adjust the gain trim (R54) for null. For V4 option, adjust for ±10 millivolts; for V5 option, adjust for ±1 millivolt.

5.3.4 Current Limit Adjustment

Potentiometer R114 adjusts the output current. The current should be limited to protect the recording device; however, the current can be limited to 100 milliamperes into a 10 ohm load.

1. Connect a 10 volt power supply, a 10 ohm 1/2 watt load resistor, and a DC voltmeter as shown in Figure 5.3.

2. Adjust R114 until the voltmeter reads 1.0 volts ±10%.

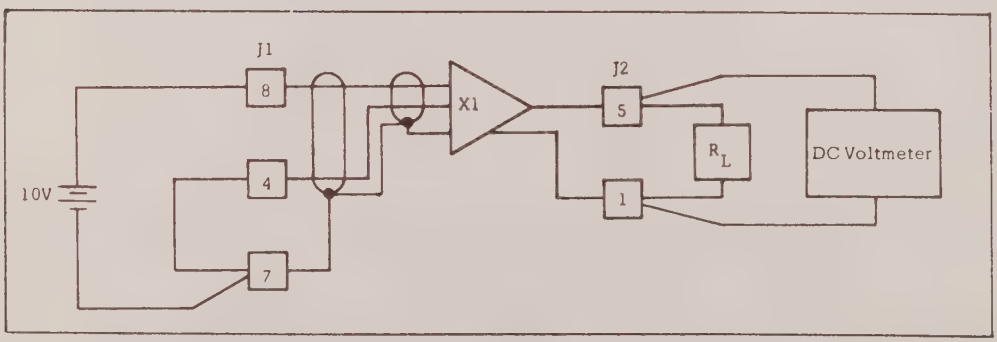


Figure 5.3 - Test Setup, Current Limit Adjust

*The gain accuracy of the amplifier can be no greater than the accuracy of the voltage divider used.

5.4 MAJOR CALIBRATION

Disassemble the amplifier per paragraph 5.5.

5.4.1 Output Amplifier Zero Adjustment

Potentiometer R67 (reference assembly drawing 402473) adjusts the zero of the output amplifier.

1. Apply power to the amplifier and allow 30 minutes for warm-up.
2. Connect terminal E60 (reference assembly drawing 402473) to output common (pin 1 of connector J2).
3. Connect an oscilloscope or millivoltmeter to output (pin 5 of connector J2) and output common (pin 1 of connector J2).
4. Set the front panel GAIN vernier (R55) full counterclockwise.
5. Adjust potentiometer R67 (reference assembly drawing 402473) for ±5 volts.
6. Remove the common connection from terminal E60; connect terminal E61 to common.
7. Adjust potentiometer R52 (reference assembly drawing 402473) for zero volts ±200 microvolts.
8. Remove the common connection to terminal E61.

5.4.2 Referenced to Output (RTO) Zero Adjustment

1. Connect the P(J1-8), N(J1-4), and guard (J1-7) leads together.
2. Place the GAIN switch to the gain of 1.
3. Connect a millivoltmeter to output (J2-5) and output common (J2-1).
4. Set the front panel GAIN vernier (R55) fully counterclockwise.
5. Set the front panel ZERO (R60) for zero volts ±500 microvolts; record this voltage for further reference.
6. Set the front panel GAIN vernier (R55) fully clockwise; adjust potentiometer R52 (reference assembly drawing 402473) for the same value recorded in step 5.

7. Set the front panel GAIN vernier (R55) fully counterclockwise. The offset voltage should be the same as the voltage recorded in step 5.

8. Repeat steps 4 through 7 until the offset voltage remains the same.

5.4.3 Referred to Input (RTI) Voltage Zero Adjustments

Perform the calibration procedure in paragraph 5.3.1.

5.4.4 Referred to Input (RTI) Current Zero Adjustment

Perform the calibration procedure in paragraph 5.3.2.

5.4.5 Gain Accuracy Adjustment

Perform the calibration procedure in paragraph 5.3.3.

5.4.6 Current Limit Adjustment

Perform the calibration procedure in paragraph 5.3.4.

5.5 AMPLIFIER DISASSEMBLY

Remove eight, number 6, Phillips flat-head screws from the aluminum support (right-hand side of the amplifier as viewed from the front panel.)

To remove the cover, place the amplifier in the left hand and pull the cover toward the rear of the amplifier as shown in Figure 5.4a.

To remove the aluminum support, remove six, number 4, Phillips pan-head screws holding the circuit board assembly to the aluminum support. Three screws are at the top of the circuit board assembly; the other three screws are at the bottom of the circuit board assembly. Place the amplifier in the left hand and push the circuit board assembly as shown in Figure 5.4b.

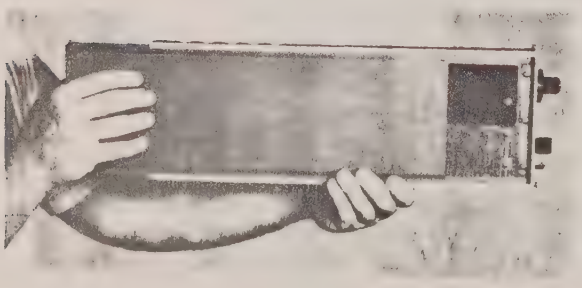


Figure 5.4a

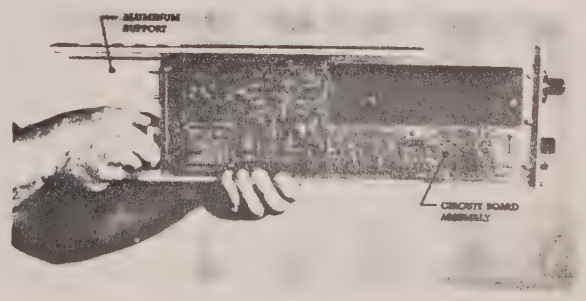


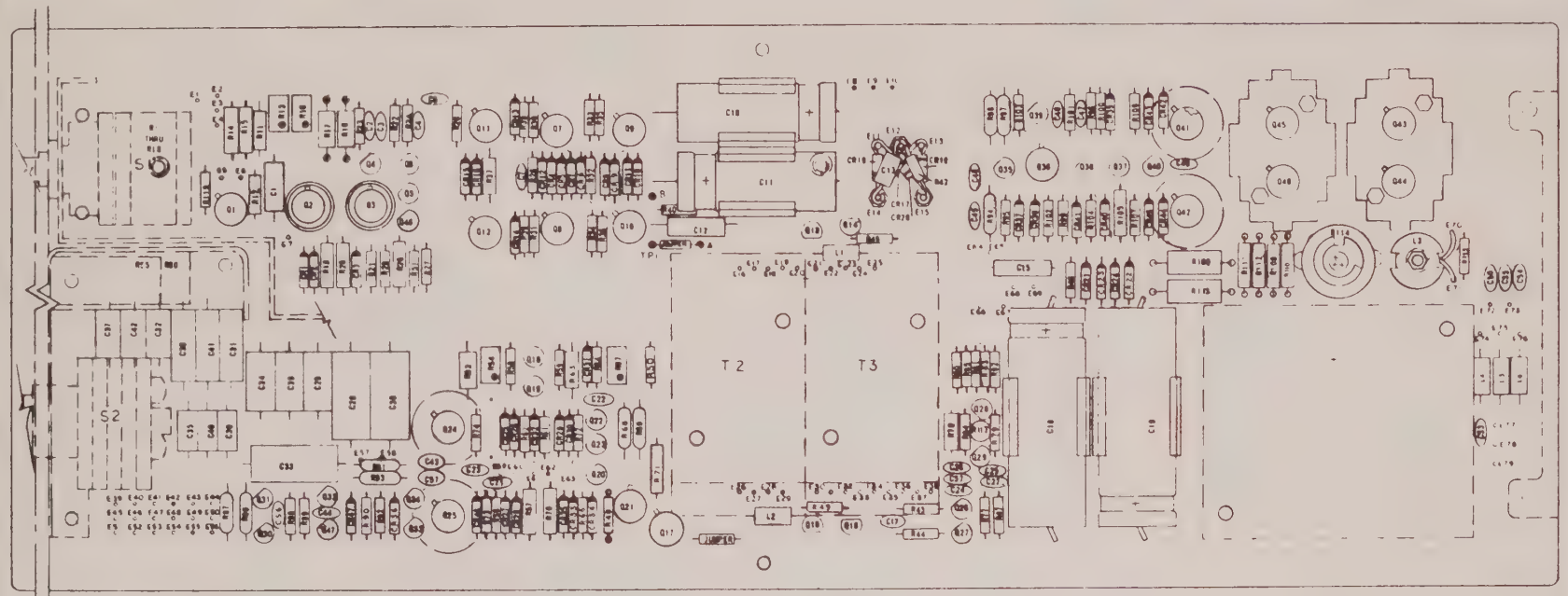
Figure 5.4b

SECTION 6

DRAWINGS AND PARTS LIST

6.1 DRAWINGS

PCB Assembly - 2860 - V4	402943
Schematic - 2860 - V4	430654
PCB Assembly - 2860 - V5	402944
Schematic - 2860 - V5	430785
Dimensional Outline - 2860	452648
Dimensional Outline - 2808-1	452402
Wiring Diagram - Enclosure Model 2808-1	430590
Dimensional Outline - 2808-2	452403
Wiring Diagram - Enclosure Model 2808-2	430591
Assembly - 2802-2	402948



QTY REQD	DANA PART NUMBER	NOMENCLATURE OR DESCRIPTION	CODE IDENT	SPECIFICATION OR VENDOR P/N	ITEM NO
		LIST OF MATERIAL OR PARTS LIST			

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS .X ±.1 .XX ±.03 ANGLES 0° 30' FORMED ANGLES ±1°

MATERIAL

FINISH

CONTRACT NO

DRAWN M. Shade 7/10/81

CHECK R Prahal 7/10/81

DESIGN H.E. Sellers 7/10/81

PROJ ENGR

DANA LABORATORIES INC.
IRVINE, CALIFORNIA

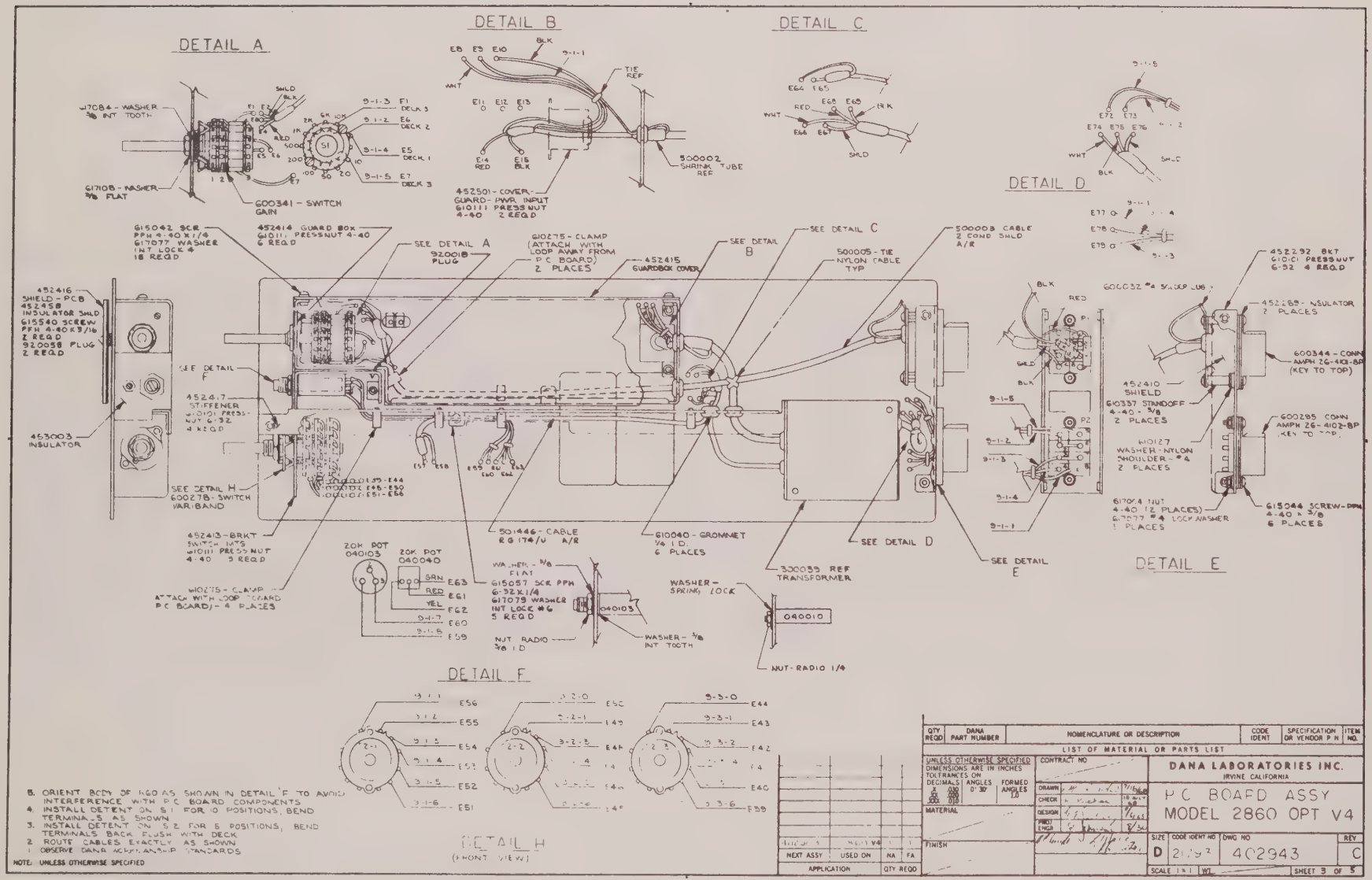
PC BOARD ASSY
MODEL 2860 OPT V4

SIZE	CODE IDENT NO	DWG NO	REV
D	21793	402943	C

BOARD V1 | SHEET 1 OF 2

402902	2860	1	
NEXT ASSY	USED ON	MA	FA
APPLICATION		QTY REQD	

NOTE UNLESS OTHERWISE SPECIFIED


DETAIL A
DETAIL B
DETAIL C
DETAIL D
DETAIL E
DETAIL F
DETAIL H
(FRONT VIEW)
W7084 - WASHER 3/8 INT TOOTH
G1710B - WASHER 3/8 FLAT
G00341 - SWITCH GAIN
452501 - COVER - GUARD - PWR. INPUT 610111 PRESS NUT 4-40 2 REQD
500002 SHRINK TUBE REF
615042 SCR PPH 4-40 X 1/4 617077 WASHER INT LOCK 4 18 REQD
452414 GUARD BOX 610111 PRESSNUT 4-40 6 REQD
SEE DETAIL A
920018 PLUG
610275 - CLAMP (ATTACH WITH LOOP AWAY FROM P.C. BOARD) 2 PLACES
452415 GUARDBOX COVER
SEE DETAIL B
SEE DETAIL C
500003 CABLE 2 COND SHLD A/R
500005 - TIE NYLON CABLE TYP
452416 SHIELD - PCB 452458 INSULATOR SHLD 615540 SCREW PPH 4-40 X 3/16 2 REQD 920058 PLUG 2 REQD
453003 INSULATOR
SEE DETAIL F
452417 STIFFENER 610101 PRESS-NUT 6-32 4 REQD
SEE DETAIL H 600278 - SWITCH VARIBAND
452413 - BRKT SWITCH MTG 610111 PRESS NUT 4-40 3 REQD
610275 - CLAMP ATTACH WITH LOOP TOWARD P.C. BOARD) - 4 PLACES
20K POT 040103
20K POT 040040
GRN
RED
YEL
E63
E61
E62
E60
E59
WASHER - 3/8 FLAT
615057 SCR PPH 6-32 X 1/4 617079 WASHER INT LOCK #6 5 REQD
040103
NUT RADIO 3/8 I.D.
WASHER - 3/8 INT TOOTH
501446 - CABLE RG 174/U A/R
610040 - GROMMET 1/4 I.D. 6 PLACES
330039 REF TRANSFORMER
WASHER - SPRING LOCK
040010
NUT - RADIO 1/4
SEE DETAIL D
SEE DETAIL E
600032 #4 SPADE LUG
452289 - INSULATOR 2 PLACES
600344 - CONN AMPH 26-403-BP (KEY TO TOP)
452410 SHIELD
610337 STANDOFF 4-40 - 3/8 2 PLACES
600285 CONN AMPH 26-4102-BP (KEY TO TOP)
610127 WASHER - NYLON SHOULDER - #4 2 PLACES
617074 NUT 4-40 (2 PLACES) 617077 #4 LOCK WASHER 1 PLACES
615044 SCREW - PPH 4-40 X 3/8 6 PLACES
452292 BKT 610101 PRESSNUT 6-32 4 REQD
E56
E55
E54
E53
E52
E51
E49
E48
E47
E46
E44
E43
E42
E40
E39

5. ORIENT BODY OF R60 AS SHOWN IN DETAIL F TO AVOID INTERFERENCE WITH P.C. BOARD COMPONENTS.
4. INSTALL DETENT ON S1 FOR 10 POSITIONS, BEND TERMINALS AS SHOWN
3. INSTALL DETENT ON S2 FOR 6 POSITIONS, BEND TERMINALS BACK FLUSH WITH DECK
2. ROUTE CABLES EXACTLY AS SHOWN
1. OBSERVE DANA WORKMANSHIP STANDARDS

NOTE: UNLESS OTHERWISE SPECIFIED

QTY REQD	DANA PART NUMBER	NOMENCLATURE OR DESCRIPTION	CODE IDENT	SPECIFICATION OR VENDOR P N	ITEM NO.

LIST OF MATERIAL OR PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS: .XX ±.030, .XXX ±.010; ANGLES 0° 30'; FORMED ANGLES 1/2

MATERIAL

FINISH

CONTRACT NO

DRAWN 9/15/66
CHECK
DESIGN 9/15/66
PROJ ENGR 9/15/66

DANA LABORATORIES INC.
IRVINE CALIFORNIA

P C BOARD ASSY
MODEL 2860 OPT V4

SIZE	CODE IDENT NO	DWG NO	REV
D	27972	402943	C

SCALE 1 & 1 WT SHEET 3 OF 5

NEXT ASSY	USED ON	NA	FA
APPLICATION		QTY REQD	

REF DES OR ITEM	P/N	DESCRIPTION	QTY
C1	121473	.0015 UF	1
C2	100012	33 pF	3
C3	101174	.001 UF	12
C4	100012	33 pF	REF
C5	101175	220 pF	2
C6		NOT USED	
C7	101041	470 pF	1
C8		NOT USED	
C9		NOT USED	
C10	110081	100 UF	2
C11	110081	100 UF	REF
C12	121003	.047 UF	1
C13	120131	.015 UF	4
C14		NOT USED	
C15	121488	.022 UF	1
C16		NOT USED	
C17	101174	.001 UF	REF
C18	110082	500 UF	2
C19	110083	500 UF	REF
C20	101041	470 pF	1
C21	101842	156 pF	1
C22	100018	120 pF	2
C23	100010	68 pF	1
C24	101174	.001 UF	REF
C25	101174	.001 UF	REF
C26	101174	.001 UF	REF
C27	101174	.001 UF	REF
C28	120129	1.5 UF	3
C29	120139	15 UF	3
C30	120131	.015 UF	REF
C31	130951	[illegible]	3
C32	130956	200 pF	2
C33	120129	1.5 UF	REF
C34	120130	15 UF	REF
C35	120131	.015 UF	REF
C36	130951	.0015 UF	REF
C37	130956	200 pF	REF
C38	120129	1.5 UF	REF
C39	120130	15 UF	REF
C40	120131	.015 UF	REF
C41	120951	.0015 UF	REF
C42	130957	[illegible] pF	1
C43	101175	220 pF DISC	REF
C44	100005	22 pF	1
C45	100012	33 pF	REF
C46	101145	100 pF	1
C47	101174	.001 UF	REF
C48	100010	120 pF	REF
C49	101182	47 pF	1
C50	101174	.001 UF	REF
C51	101000	680 pF	1
C52		NOT USED	
C53	101174	.001 UF	REF
C54	101174	.001 UF	REF
C55	101174	.001 UF	REF
C56	101000	330 pF	1
C57	101174	.001 UF	REF
CR1	210015	HP2800	2
CR2	210015	HP2800	REF
CR3	211003	D10	20
CR4	211003	D10	REF
CR5	211003	D10	REF
CR6	211003	D10	REF
CR7	211003	D10	REF
CR8	220010	1N9648	4
CR9	220010	1N9648	REF
CR10	211003	D10	REF
CR11	211003	D10	REF
CR12	211003	D10	REF
CR13	220030	1.482 4AZ5	8
CR14	220010	1N752A	4
CR15	220010	1N752A	REF

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CR16	220030	1/482.4AZ5	REF
CR17	210004	SD4	8
CR18	210004	SD4	REF
CR19	210004	SD4	REF
CR20	210004	SD4	REF
CR21	210004	SD4	REF
CR22	210004	SD4	REF
CR23	210004	SD4	REF
CR24	210004	SD4	REF
CR25	220010	1N9648	REF
CR26	220010	1N9648	REF
CR27	211003	D10	REF
CR28	211003	D10	REF
CR29	211003	D10	REF
CR30	220030	1/482.4AZ5	REF
CR31	220030	1/482.4AZ5	REF
CR32	210004	1.482.4AZ5	REF
CR33	211003	D10	REF
CR34	211003	D10	REF
CR35	211003	D10	REF
CR36	220030	1/482.4AZ5	REF
CR37	211003	D10	REF
CR38	211003	D10	REF
CR39	220030	1/482.4AZ5	REF
CR40	211003	D10	REF
CR41	220030	1/482.4AZ5	REF
CR42	211003	D10	REF
CR43	211003	D10	REF
CR44	211003	D10	REF
CR45	211003	D10	REF
CR46	220030	1/482.4AZ5	REF
CR47	220030	1/482.4AZ5	REF
L1	310034	200 UH	2
L2	310034	200 UH	REF
L3	482470	30 UH	1
L4	310033	100 UH	3
L5	310033	100 UH	REF
L6	310033	100 UH	REF
Q1	201004	2N1304	2
Q2	482719	FSV ASSY	REF
Q3	201295	2N5 376 DUAL	1
Q4	200043	2N3565	18
Q5	200043	2N3565	REF
Q6	200043	2N3565	REF
Q7	200012	2N [illegible]	1
Q8	200035	014	1
Q9	200035	014	REF
Q10	200012	009	REF
Q11	200012	009	REF
Q12	200012	014	REF
Q13	200072	MATCHED PAIR	2
Q14			
Q15	200072	MATCHED PAIR	REF
Q16			
Q17	201004	2N1304	REF
Q18	200022	012	4
Q19	200043	2N3565	REF
Q20	200043	2N3565	REF
Q21	200040	016	
Q22	200043	2N3565	REF
Q23	200022	012	REF
Q24	200011	008	REF
Q25	200035	014	REF
Q26	200037	2N3648	2
Q27	200037	2N3648	REF

REF DES OR ITEM	P/N	DESCRIPTION	QTY
Q28	200074	MATCHED PAIR	1
Q29			
Q30	200043	2N3565	REF
Q31	200043	2N3565	REF
Q32	200043	2N3565	REF
Q33	200022	012	REF
Q34	200043	2N3565	REF
Q35	200043	2N3565	REF
Q36	200040	016	REF
Q37	200022	012	REF
Q38	200043	2N3565	REF
Q39	200043	2N3565	REF
Q40	200043	2N3565	REF
Q41	200011	009	REF
Q42	200035	014	REF
Q43	200035	014	REF
Q44	200035	014	REF
Q45	200011	009	REF
Q46	200043	2N3565	REF
Q47	200043	2N3565	REF
Q48	200043	2N3565	REF
R1	020368	10k 1%	1
R2	020141	5k 1%	1
R3	029305	2k 1%	1
R4	020138	1k 1%	1
R5	020268	500 1%	1
R6	020202	200 1%	1
R7	020364	100 1%	1
R8	029335	50 1%	1
R9	020363	20 1%	1
R10	029382	10 1%	1
R11	010336	[illegible]	2
R12	010334	[illegible]	REF
R13	049092	20k POT	2
R14	010112	5.36k [illegible]	2
R15	010128	68.1k [illegible]	1
R16	049083	500 POT	2
R17	482715	FSV ASSY	REF
R18	482715	FSV ASSY	REF
R19	010122	20.7k [illegible]	1
R20	010258	1k [illegible]	1
R21	000102	1k	3
R22	000302	3k	1
R23	000134	130k	2
R24	000134	130k	REF
R25	010022	40.4k [illegible]	1
R26	000912	9.1k	1
R27	000153	15k	1
R28	000821	820	REF
R29	000101	100	2
R30	000331	330	2
R31	000182	1.8k	2
R32	000220	82	2
R33	000510	51	2
R34	000510	51	REF
R35	000104	100k	2
R36	000104	100k	REF
R37	001102	8.1k 1%	3
R38	000331	330	REF
R39	000112	1.1k	1
R40	000620	62	REF
R42	000221	220	3
R43	000100	10 OHM	3
R44	000100	10 OHM	REF
R45	000431	430	2
R46	000221	220	REF
R47	000101	100	REF
R48	482715	FSV ASSY	REF

REF DES OR ITEM	P/N	DESCRIPTION	QTY
R49	000431	430	REF
R50	000472	4.7k	1
R51	000102	1.0k	REF
R52		NOT USED	
R53	020418	0.35k 1%	1
R54	040003	500 POT	REF
R55	040103	20k POT	1
R56	000102	1k	REF
R57	010150	2000 [illegible]	1
R58	000202	2k	3
R59	040048	200 POT	1
R61	000152	1.5k	1
R62	000221	220	REF
R63	001102	8.1k 1/2W	REF
R64	000382	3.6k	1
R65		NOT USED	
R66	000361	360	2
R67	040082	20k POT	REF
R68	010075	71.5k [illegible]	4
R69	010075	71.5k [illegible]	REF
R70	010077	90.9k [illegible]	1
R71	010080	10.0k [illegible]	1
R72	000361	360	REF
R73	000512	5.1k	3
R74	008301	300	1
R75		NOT USED	
R76		NOT USED	
R77	000201	200	REF
R78	001706	510 1.2%	1
R79	000122	1.2k	3
R80	000151	150	2
R81	000201	200	REF
R82	000201	200	REF
R83	000122	1.2k	REF
R84	000122	1.2k	REF
R85	000151	150	REF
R86	010211	4.42k [illegible]	1
R87	010324	10.7k [illegible]	1
R88	000822	8.2k	1
R89	000202	2k	REF
R90	000223	22k	1
R91	010029	4.99k [illegible]	1
R92	[illegible]	240	2
R93	010005	4.53k [illegible]	1
R94	010112	5.36k [illegible]	REF
R95	000511	510	2
R96	000512	5.1k	REF
R97	010075	71.5k [illegible]	REF
R98	010075	71.5k [illegible]	REF
R99	[illegible]	18k	1
R100	[illegible]	2k	REF
R101	[illegible]	5.1k	REF
R102	010113	154 [illegible]	1
R103	000511	510	REF
R104	001102	8.1k 1/2W	REF
R105	[illegible]	56k	1
R106	[illegible]	160	2
R107	[illegible]	240	REF
R108	001751	33 OHM 1%	2
R109	001748	16.1 2%	4
R110	001748	16.1 2%	REF
R111	001748	16.1/2W	REF
R112	001748	16.1/2W	REF
R113	001751	33 OHM 1%	REF
R114	040052	50 OHM POT	1
R115	000100	10	REF
R116	020381	1k 2%	1
R117	040098	X OHM POT	1
R118	000102	1k	REF
R119	00016	60	REF

REF DES OR ITEM	P/N	DESCRIPTION	QTY
T1	300038	POWER XMFR	1
T2	482473	ISOLATOR XMFR ASSY	1
T3	482472	DRIVE XMFR ASSY	1
	482715	FSV ASSY	1
	410385	PCB POST ISO	1
	430854	SCHEMATIC	REF
	452280	INSULATOR	2
	452282	BRKT COMM MTG	1
	452343	CASE MODIFIED 820250 W/GLASS PWR	2
	452410	SHIELD-CONNECTOR	1
	452413	BRKT W/B SWITCH AND POT MTG	1
	452414	GUARD BOX AMP	1
	452415	COVER-GUARD BOX	1
	452416	SHIELD-PC BOARD	1
	452417	BRKT-PCB STIFFN	1
	453003	INS-DECORATIVE	1
	452458	INSULATOR-SHIELD	1
	452501	GUARD COVER-PWR INPUT	1
	452723	STDOFF-COMP SUPPORT	12
	482726	CLIP-COMP 500 DIA STG	2
	482726	CLIP COMP .800 DIA STG	2
	500002	TUBING-SHRINK 2510	A/R
	500003	CABLE-BELDEN 8451	A/R
	500008	TIE CORD-NYLON	A/R
	501448	CABLE RG174/U	A/R
	524600	WIRE-24 GA STR O COLOR	A/R
	524911	WIRE 24 GA STR 9-1-1 COLOR	A/R
	524912	WIRE-24 GA STR 9-1-2 COLOR	A/R
	524913	WIRE-24 GA STR 9-1-3 COLOR	A/R
	524914	WIRE-24 GA STR 9-1-4 COLOR	A/R
	524915	WIRE 24 GA STR 9-1-5 COLOR	A/R
	524916	WIRE-24 GA STR 9-1-6 COLOR	A/R
	524917	WIRE-24 GA STR 9-1-7 COLOR	A/R
	524918	WIRE-24 GA STR 9-1-8 COLOR	A/R
	524920	WIRE-24 GA STR 9-2-0 COLOR	A/R
	524921	WIRE-24 GA STR 9-2-1 COLOR	A/R
	524923	WIRE 24GA STR 9-2-3 COLOR	A/R
	524924	WIRE 24GA STR 9-2-4 COLOR	A/R
	524925	WIRE 24GA STR 9-2-5 COLOR	A/R

P/N	DESCRIPTION	QTY
524928	WIRE 24 GA STR 9-2 B COLOR	A/R
524830	WIRE 24 GA STR 9.3 0 COLOR	A/R
524831	WIRE-24 GA STR 9-3-1 COLOR	A/R
524832	WIRE 24 GA STR 9-3-2 COLOR	A/R
524934	WIRE 24 GA STR 9-3-4 COLOR	A/R
524835	WIRE 24 GA STR 9-3 5 COLOR	A/R
524836	WIRE-24 GA STR 9-3-6 COLOR	A/R
524989	WIRE 24 GA STR 9 COLOR	A/R
600016	HEAT SINK IERC TSBF-032 0250	4
600032	LUG-SOLDER SMITH 1418-4	1
609068	HEAT DISS-IERC LP5038	2
600137	TERM-UH INSUL .125 DIA	2
600245	JUMPER-INSULATED	2
600278	SWITCH-ROTARY, 3 POL,10 POS	1
600295	COMM-PLUG,AMPHEN 26-4102-BP	1
600297	COMM PC JACK, CAMDEN 3394-7 03	9
600341	SWITCH-ROTARY, 2 POLE,10 POS SHT	1
600344	COMM - 8 PINS,AMPH 20-4101-8P	1
600383	TERMINAL-STOP, INSUL - CAMDEN	9
610010	RIVET-1 8 SEMI-TUB 5/32L8	8
610040	GROMMET-RUB, 1/4 INCH I D X 3 0	8
610101	NUT-PRESS, 8-32 PEM S-832-1	8
610111	NUT-PRESS, 4-40 PEM S-440-1	11
610127	WASH SHLDR NYL, # 4 SCREW	3
610186	WASH-NYLON #4	4
610252	STDOFF.SS-4-40 X 1/8 LG I 6 8 2 OG WTG	3
610275	CLAMP-CABLE PL 8U0816 3-4-1	8
610337	STD-OFF 4 HEX X 5.8 L 4 40 THD	2
615015	SCREW PPH 2-56 X 5/6 STLS	4
615042	SCREW PPH 6-48 X 1/4 STLS	15
615044	SCREW PPH 4-40 X 3/8	8
524928	WIRE 24 GA STR 9-2 B COLOR	A/R
524830	WIRE 24 GA STR 9.3 0 COLOR	A/R
524831	WIRE-24 GA STR 9-3-1 COLOR	A/R
524832	WIRE 24 GA STR 9-3-2 COLOR	A/R
524934	WIRE 24 GA STR 9-3-4 COLOR	A/R
524835	WIRE 24 GA STR 9-3 5 COLOR	A/R
524836	WIRE-24 GA STR 9-3-6 COLOR	A/R
524989	WIRE 24 GA STR 9 COLOR	A/R
600016	HEAT SINK IERC TSBF-032 0250	4
600032	LUG-SOLDER SMITH 1418-4	1
609068	HEAT DISS-IERC LP5038	2
600137	TERM-UH INSUL .125 DIA	2
600245	JUMPER-INSULATED	2
600278	SWITCH-ROTARY, 3 POL,10 POS	1
600295	COMM-PLUG,AMPHEN 26-4102-BP	1
600297	COMM PC JACK, CAMDEN 3394-7 03	9
600341	SWITCH-ROTARY, 2 POLE,10 POS SHT	1
600344	COMM - 8 PINS,AMPH 20-4101-8P	1
600383	TERMINAL-STOP, INSUL - CAMDEN	9
610010	RIVET-1 8 SEMI-TUB 5/32L8	8
610040	GROMMET-RUB, 1/4 INCH I D X 3 0	8
610101	NUT-PRESS, 8-32 PEM S-832-1	8
610111	NUT-PRESS, 4-40 PEM S-440-1	11
610127	WASH SHLDR NYL, # 4 SCREW	3
610186	WASH-NYLON #4	4
610252	STDOFF.SS-4-40 X 1/8 LG I 6 8 2 OG WTG	3
610275	CLAMP-CABLE PL 8U0816 3-4-1	8
610337	STD-OFF 4 HEX X 5.8 L 4 40 THD	2
615015	SCREW PPH 2-56 X 5/6 STLS	4
615042	SCREW PPH 6-48 X 1/4 STLS	15
615044	SCREW PPH 4-40 X 3/8	8

REF DES OR ITEM	P/N	DESCRIPTION	QTY
	615047	SCREW PPH 4-40 X 5/8	2
	615051	SCREW PPH 8-32 X 1/4 STLS	9
	615540	SCREW PFH 4-40 X 3/16 STLS	2
	611004	HEX NUT 4-40 STD STLS	2
	617014	HEX NUT 2-56 RADIO, STLS	4
	617018	HEX NUT 4-40 RADIO	2
	617075	WASHER-INT LOCK #2 STLS	4
	617077	WASHER-INT LOCK #4 STLS	22
	617078	WASHER-INT LOCK #8 STLS	9
	617084	WASHER-INT LOCK 3 8 STLS	1
	617108	WASHER-FLAT 3 8 STLS	1
	920006	TRANS PAD LARGE	19
	920010	SOLDER 63 37 BAR	A/R
	920018	BUT-PLUG,FASTER	1
	920026	SOLDER-WIRE .032X63 37 RESIN CORE	A/R
	920058	PLUG PLASTER 207 040241 00-0101	2
	920082	TRANS PAD-ROSS 10037	44
	920271	CUP-ENCAPSULATING W/GLASS #4 BLK	2

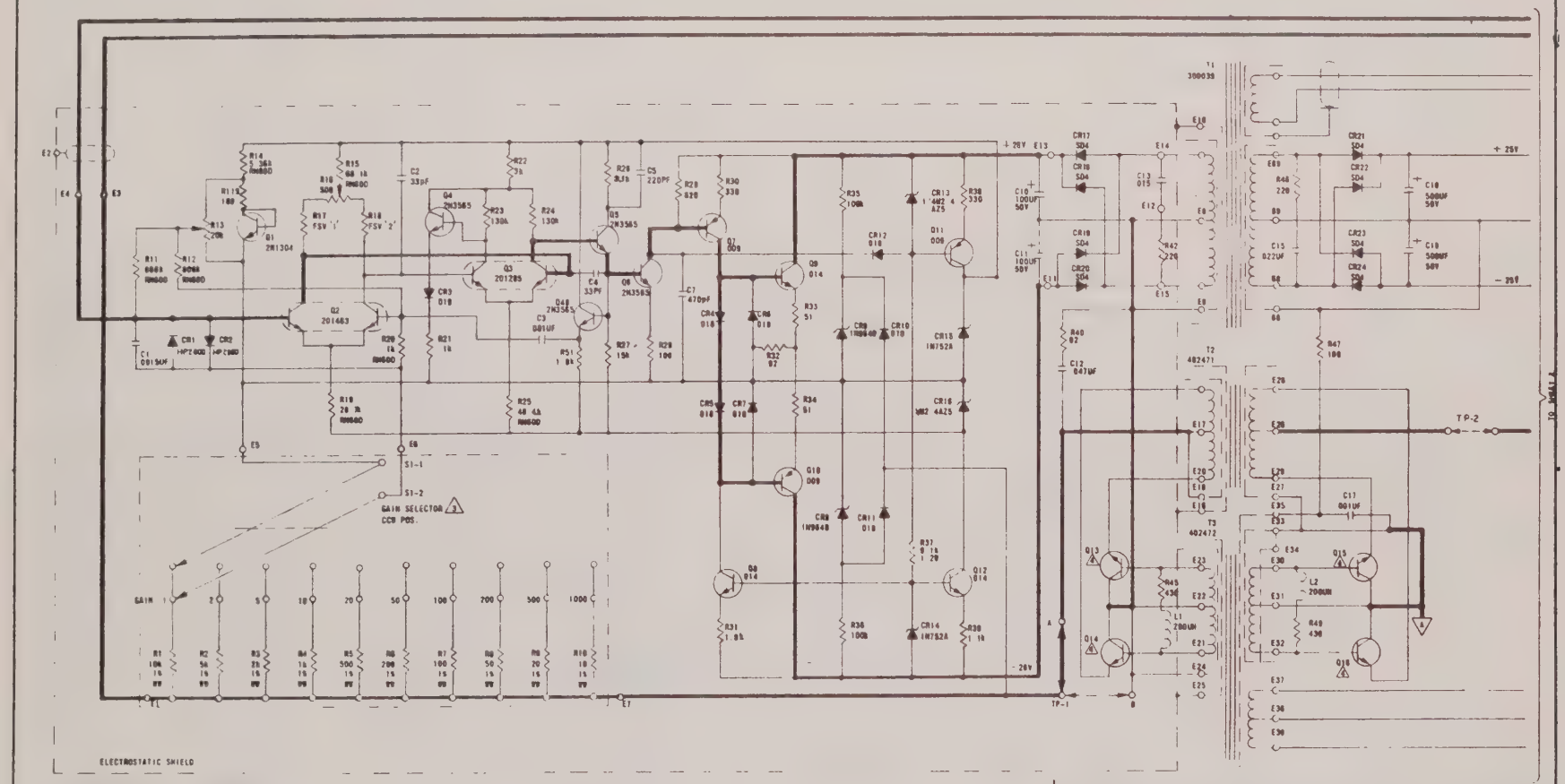
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS .XX ± .01 .XXX ± .005 ANGLES ± 1/2° MATERIAL

DANA LABORATORIES INC
IRVINE CALIFORNIA

PC BOARD ASSY - MODEL 2860 OPT V4

SIZE	CODE IDENT NO	DWG NO	REV
D	21793	402943	C

SCALE NONE SHEET 5 OF 5



5 'E' NUMBERS DENOTE EYELETS AND CORRESPOND TO POINTS ON P C BOARD ASSY (P/N 402373)

4 TRANSISTORS ARE MATCHED PAIRS
Q13 AND Q14 (P/N 200072) Q15 AND Q16 (P/N 200072)
Q28 AND Q29 (P/N 200074)

3 RSS (GAIN) R80 (ZERO) S1 (GAIN SELECTOR) AND S2 (BANDWIDTH SELECTOR) ARE FRONT PANEL CONTROLS

2 HIGHEST REFERENCE DESIGNATORS USED
CR87 CR47 L8 Q47 R118 T3

1 ALL RESISTORS ARE IN OHMS ± 5% | 4B CARBON

NOTE UNLESS OTHERWISE SPECIFIED

QTY REQD	DANA PART NUMBER	NOMENCLATURE OR DESCRIPTION	CODE IDENT	SPECIFICATION OR VENDOR P/N	ITEM NO.
		LIST OF MATERIAL OR PARTS LIST			

402473	2N60V4	1	1	
NEXT ASSY	USED ON	NA	FA	
APPLICATION		QTY REQD		

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS .X ±.03, .XX ±.010, .XXX ±.005 ANGLES 0° 30' FORMED ANGLES ±1°

MATERIAL

FINISH

CONTRACT NO

DRAWN 3/4/67

CHECK 3/4/67

DESIGN 3/4/67

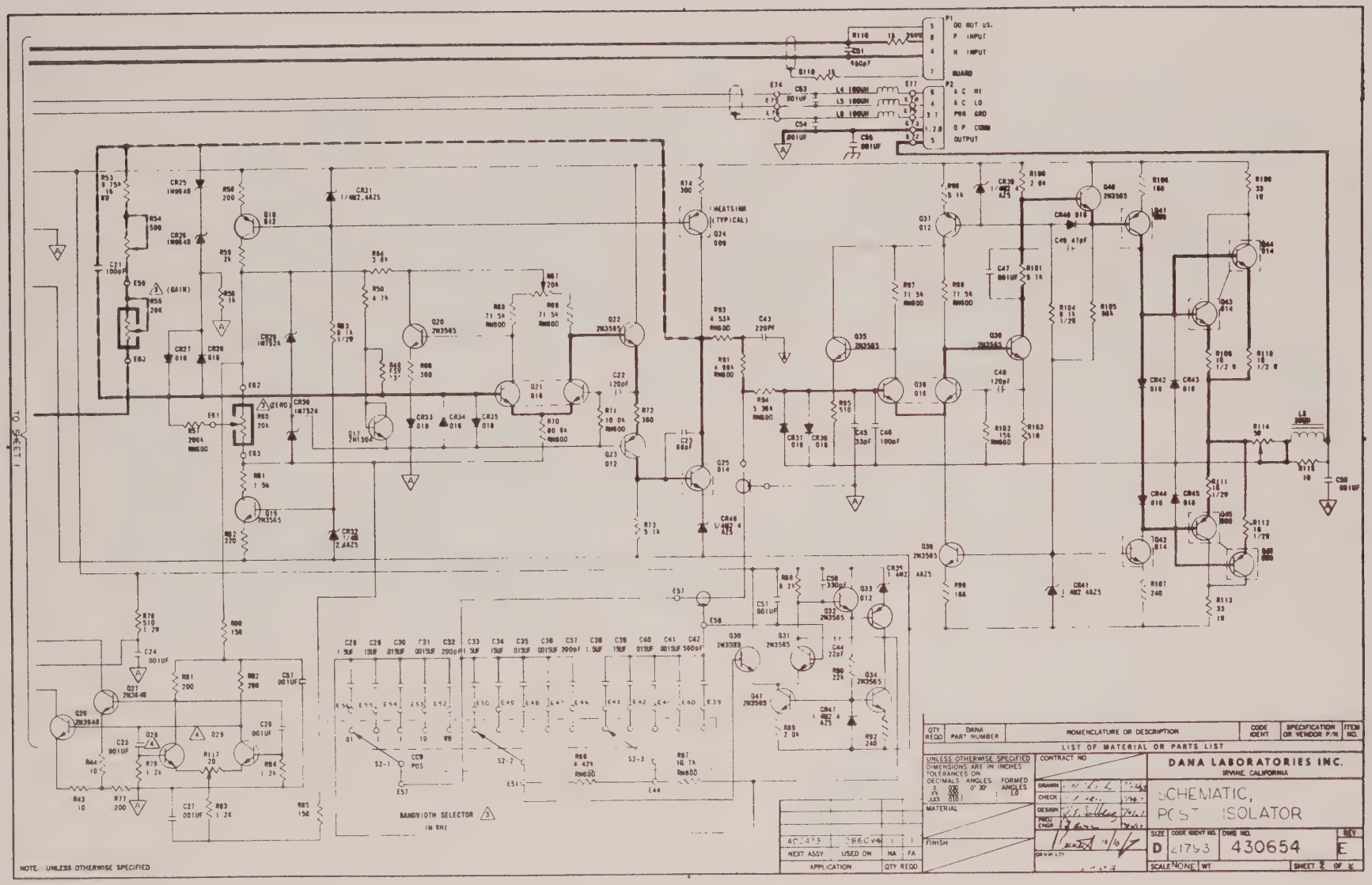
FIRST ENGR 3/4/67

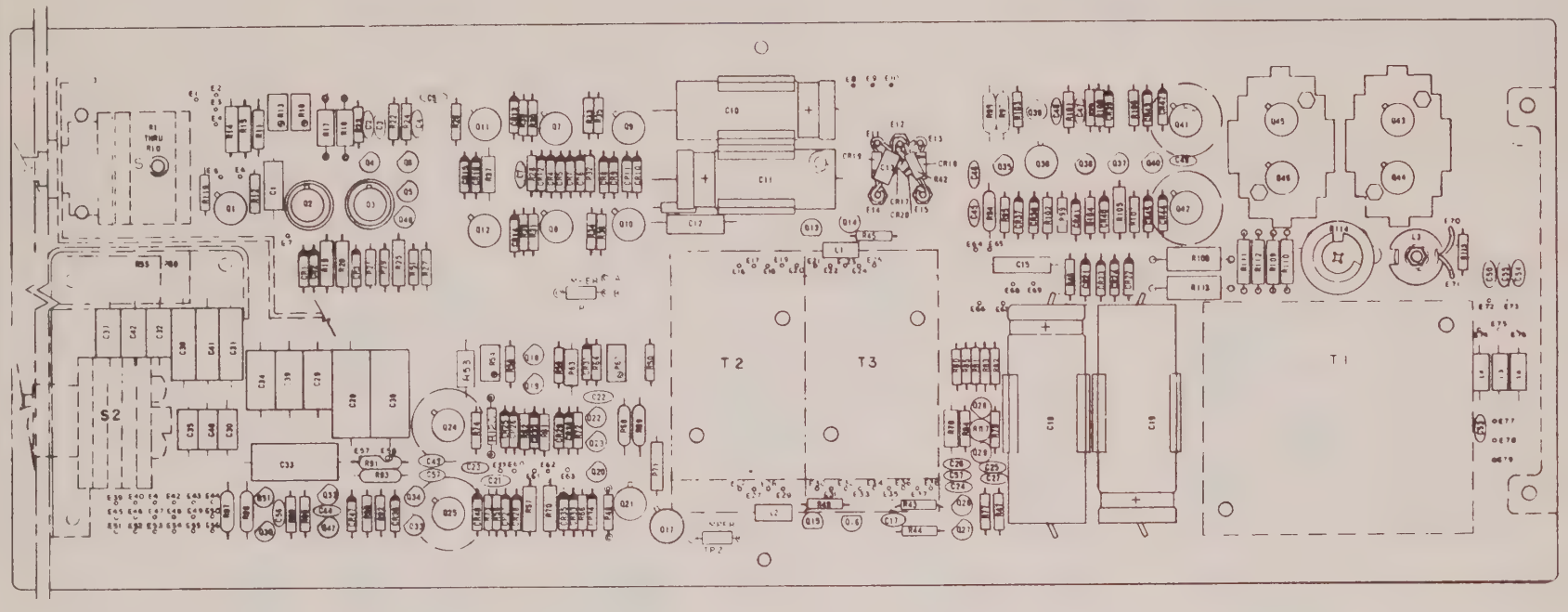
DANA LABORATORIES INC.
IRVINE, CALIFORNIA

SCHEMATIC,
POST ISOLATOR

SIZE	CODE IDENT NO	DWG NO.	REV
D	21793	430654	E

SCALE NONE WT SHEET 1 OF 2


P1
DO NOT US.
P INPUT
N INPUT
GUARD
P2
A C HI
A C LO
POR GRD
O P COMM
OUTPUT
HEATSINK (TYPICAL)
(GAIN)
ZERO
BANDWIDTH SELECTOR
IN KHZ
S2-1
S2-2
S2-3
CCW POS
NOTE. UNLESS OTHERWISE SPECIFIED
LIST OF MATERIAL OR PARTS LIST
QTY REQD
DANA PART NUMBER
NOMENCLATURE OR DESCRIPTION
CODE IDENT
SPECIFICATION OR VENDOR P/N
ITEM NO.
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ANGLES FORMED
.X ±.030 0° 30'
.XX ±.010
.XXX ±.005
MATERIAL
FINISH
CONTRACT NO
DRAWN
CHECK
DESIGN
PROJ ENGR
DANA LABORATORIES INC.
IRVINE, CALIFORNIA
SCHEMATIC,
POST ISOLATOR
SIZE
CODE IDENT NO.
DWG NO.
REV
D
21793
430654
E
SCALE NONE
WT
SHEET 2 OF 6
NEXT ASSY
USED ON
NA
FA
APPLICATION
QTY REQD



QTY REQD	DANA PART NUMBER	NOMENCLATURE OR DESCRIPTION	CODE IDENT	SPECIFICATION OR VENDOR P/N	ITEM NO.

LIST OF MATERIAL OR PARTS LIST

DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ANGLES FORMED ANGLES
.X ± .030 0° 30' ±1°
.XX ± .010
.XXX ± .005

MATERIAL

FINISH

CONTRACT NO.

DRAWN
CHECK
DESIGN
PROJ. ENGR

DANA LABORATORIES INC.
IRVINE, CALIFORNIA

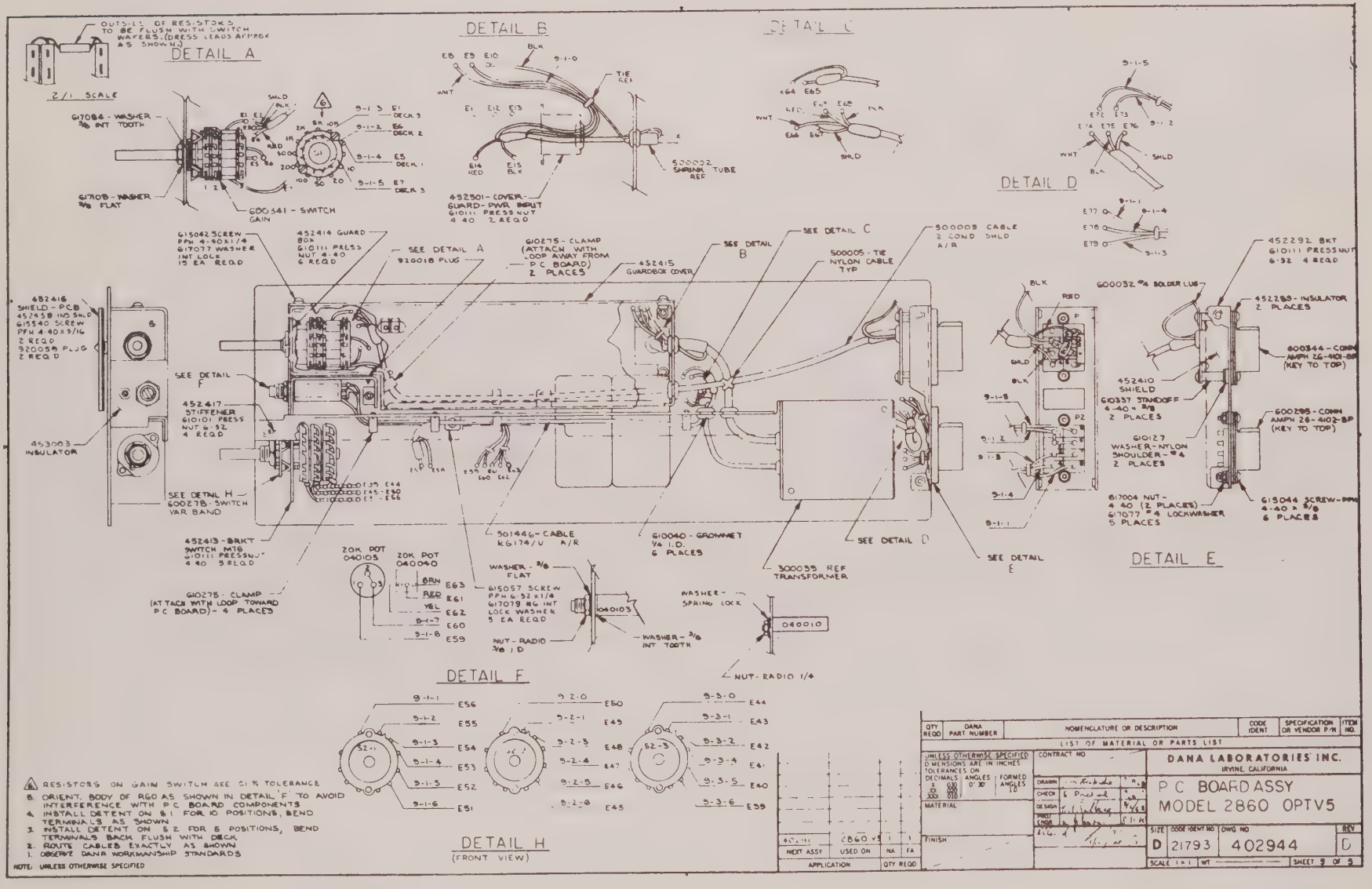
PC BOARD ASSY
MODEL 2860 OPT V5

SIZE	PART/DRWG NO	DWG NO	REV
D	21793	402944	D

SCALE 2/1 | WT | SHEET 1 OF 5

402910	2860 V5		
NEXT ASSY	USED ON	RA	FA
APPLICATION		QTY REQD	

NOTE: UNLESS OTHERWISE SPECIFIED


DETAIL A
DETAIL B
DETAIL C
DETAIL D
DETAIL E
DETAIL F
DETAIL H
(FRONT VIEW)
2/1 SCALE
OUTSIDE OF RESISTORS TO BE FLUSH WITH SWITCH WAFERS. (DRESS LEADS APPROX AS SHOWN.)
617086 - WASHER 3/8 INT TOOTH
617088 - WASHER 3/8 FLAT
600341 - SWITCH GAIN
492501 - COVER-GUARD-PWR INPUT
610111 PRESS NUT 4-40 2 REQD
500002 SHRINK TUBE REF
615042 SCREW PPH 4-40X1/4
617077 WASHER INT LOCK
15 EA REQD
452414 GUARD BOX
610111 PRESS NUT 4-40
6 REQD
SEE DETAIL A
920018 PLUG
610275 - CLAMP (ATTACH WITH LOOP AWAY FROM P.C. BOARD)
2 PLACES
452415 GUARDBOX COVER
SEE DETAIL B
SEE DETAIL C
500005 - TIE NYLON CABLE TYP
500008 CABLE 2 COND SHLD A/R
452416 SHIELD - PCB
452458 INS SHLD
615540 SCREW PPH 4-40X3/16
2 REQD
920059 PLUG 2 REQD
SEE DETAIL F
452417 STIFFENER
610101 PRESS NUT 6-32
4 REQD
453003 INSULATOR
SEE DETAIL H
600278 - SWITCH VAR BAND
452413 - BRKT SWITCH MTG
610111 PRESS NUT 4-40 3 REQD
610275 - CLAMP (ATTACH WITH LOOP TOWARD P.C. BOARD) - 4 PLACES
501446 - CABLE KG174/U A/R
610040 - GROMMET 1/4 I.D. 6 PLACES
300039 REF TRANSFORMER
SEE DETAIL D
SEE DETAIL E
20K POT 040103
20K POT 040040
BRN
RED
YEL
E63
E61
E62
E60
E59
9-1-7
9-1-8
615057 SCREW PPH 6-32 X 1/4
617079 #6 INT LOCK WASHER
5 EA REQD
WASHER - 3/8 FLAT
NUT - RADIO 3/8 I.D.
040103
WASHER - 3/8 INT TOOTH
WASHER - SPRING LOCK
040010
NUT - RADIO 1/4
452292 BKT
610111 PRESS NUT
6-32 4 REQD
600032 #4 SOLDER LUG
452283 - INSULATOR
2 PLACES
600344 - CONN AMPH 26-4401-BP (KEY TO TOP)
452410 SHIELD
610337 STANDOFF 4-40 x 3/8
2 PLACES
600298 - CONN AMPH 28-4102-BP (KEY TO TOP)
610127 WASHER-NYLON SHOULDER - #4
2 PLACES
617004 NUT - 4-40 (2 PLACES)
617077 #4 LOCKWASHER
5 PLACES
615044 SCREW-PPH 4-40 x 5/8
6 PLACES
9-1-1 E56
9-1-2 E55
9-1-3 E54
9-1-4 E53
9-1-5 E52
9-1-6 E51
S2-1
9-2-0 E50
9-2-1 E49
9-2-3 E48
9-2-4 E47
9-2-5 E46
9-2-6 E45
S2-2
9-3-0 E44
9-3-1 E43
9-3-2 E42
9-3-4 E41
9-3-5 E40
9-3-6 E39
S2-3
RESISTORS ON GAIN SWITCH ARE 1% TOLERANCE
6. ORIENT BODY OF R60 AS SHOWN IN DETAIL 'F' TO AVOID INTERFERENCE WITH P.C. BOARD COMPONENTS
4. INSTALL DETENT ON S1 FOR 10 POSITIONS, BEND TERMINALS AS SHOWN
3. INSTALL DETENT ON S2 FOR 6 POSITIONS, BEND TERMINALS BACK FLUSH WITH DECK
2. ROUTE CABLES EXACTLY AS SHOWN
1. OBSERVE DANA WORKMANSHIP STANDARDS
NOTE: UNLESS OTHERWISE SPECIFIED
QTY REQD
DANA PART NUMBER
NOMENCLATURE OR DESCRIPTION
CODE IDENT
SPECIFICATION OR VENDOR P/N
ITEM NO.
LIST OF MATERIAL OR PARTS LIST
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON DECIMALS ANGLES FORMED ANGLES
MATERIAL
FINISH
CONTRACT NO
DRAWN
CHECK
DESIGN
PROJ LDR
ENG APPR
DANA LABORATORIES INC.
IRVINE, CALIFORNIA
P C BOARD ASSY
MODEL 2860 OPTV5
SIZE
CODE IDENT NO
DWG NO
REV
D
21793
402944
D
SCALE 1 = 1
WT
SHEET 3 OF 3
NEXT ASSY
USED ON
APPLICATION
QTY REQD

REF DES OR ITEM	P/N	DESCRIPTION	QTY
C1	121472	.0015 UF	1
C2	100012	33 pF	3
C3	101174	.001 UF	12
C4	100012	33 pF	REF
C5	101135	220 pF	2
C6		NOT USED	
C7	101841	470 pF	1
C8		NOT USED	
C9		NOT USED	
C10	110061	100 UF	2
C11	110081	100 UF	REF
C12	121093	.047 UF	1
C13	120131	.015 UF	4
C14		NOT USED	
C15	121088	.022 UF	1
C16		NOT USED	
C17	121174	.001 UF	REF
C18	110082	500 UF	2
C19	110062	500 UF	REF
C20		NOT USED	
C21	101842	150 pF DISC	1
C22	100010	120 pF	2
C23	100010	68 pF	1
C24	101174	.001 UF	REF
C25	101174	.001 UF	REF
C26	101174	.001 UF	REF
C27	101174	.001 UF	REF
C28	120129	1.5 UF	3
C29	120130	.15 UF	3
C30	120131	.015 UF	REF
C31	130051	.0015 UF	3
C32	130056	200 pF	2
C33	120129	1.5 UF	REF
C34	120130	.15 UF	REF
C35	120131	.015 UF	REF
C36	130051	.0015 UF	REF
C37	130056	200 pF	REF
C38	120129	1.5 UF	REF
C39	120130	.15 UF	REF
C40	120131	.015 UF	REF
C41	130051	.0015 UF	REF
C42	130057	560 pF	1
C43	101175	220 pF DISC	REF
C44	100005	22 pF	1
C45	100012	33 pF	REF
C46	103168	100 pF	1
C47	101174	.001 UF	REF
C48	100010	120 pF	REF
C49	101182	.01 pF	1
C50	101174	.001 UF	REF
C51	101800	680 pF	1
C52		NOT USED	
C53	101174	.001 UF	REF
C54	101174	.001 UF	REF
C55	101174	.001 UF	REF
C56	101800	330 pF	1
C57	101174	.001 UF	REF
CR1	210015	HP2800	2
CR2	210015	HP2800	REF
CR3	211003	D18	1
CR4	211003	D18	REF
CR5	211003	D18	REF
CR6	211003	D18	REF
CR7	211003	D18	REF
CR8	220018	IN9648	4
CR9	220018	IN9648	REF
CR10	211003	D18	REF
CR11	211003	D18	REF
CR12	211003	D18	REF
CR13	220030	1 4B2 4A2S	9
CR14	220018	IN752A	4
CR15	220018	IN752A	REF
CR16	220030	1 4B2 4A2S	REF
CR17	210004	SD4	8
CR18	210004	SD4	REF
CR19	210004	SD4	REF
CR20	210004	SD4	REF
CR21	210004	SD4	REF
CR22	210004	SD4	REF
CR23	210004	SD4	REF
CR24	210004	SD4	REF
CR25	220018	IN9648	REF
CR26	220018	IN9648	REF
CR27	211003	D18	REF
CR28	211003	D18	REF
CR29	220018	IN752A	REF
CR30	220019	IN752A	REF
CR31	220030	1 4B2 4A2S	REF
CR32	220030	1 4B2 4A2S	REF
CR33	211003	D18	REF
CR34	211003	D18	REF
CR35	211003	D18	REF
CR36	220030	1 4B2 4A2S	REF
CR37	211003	D18	REF
CR38	211003	D18	REF
CR39	220030	1 4B2 4A2S	REF
CR40	211003	D18	REF
CR41	220030	1 4B2 4A2S	REF
CR42	211003	D18	REF
CR43	211003	D18	REF
CR44	211003	D18	REF
CR45	211003	D18	REF
CR46	220030	1 4B2 4A2S	REF
CR47	220030	1 4B2 4A2S	REF
L1	310034	200 UH	2
L2	310034	200 UH	REF
L3	402470	30 UH	1
L4	310033	100 UH	3
L5	310033	100 UH	REF
L6	310033	100 UH	REF
Q1	251084	2N1304	2
Q2	402715	FSV ASSY	REF
Q3	201285	2ND STG DUAL	1
Q4	200043	2N3565	8
Q5	200043	2N3565	REF
Q6	200043	2N3565	REF
Q7	200011	D69	1
Q8	200035	D14	7
Q9	200035	D14	REF
Q10	200011	D69	REF
Q11	200011	D69	REF
Q12	200035	D14	REF
Q13	200072	MATCHED PAIR	2
Q14			
Q15			
Q16	200072	MATCHED PAIR	REF
Q17	201084	2N1304	REF
Q18	200022	D12	4
Q19	200043	2N3565	REF
Q20	200043	2N3565	REF
Q21	200040	D16	2
Q22	200043	2N3565	REF
Q23	200022	D12	REF
Q24	200011	D69	REF
Q25	200035	D14	REF
Q26	200037	2N3646	2
Q27	200037	2N3646	REF
Q28	200074	MATCHED PAIR	1
Q29			
Q30	200043	2N3565	REF
Q31	200043	2N3565	REF
Q32	200043	2N3565	REF
Q33	200022	D12	REF
Q34	200043	2N3565	REF
Q35	200043	2N3565	REF
Q36	200040	D16	REF
Q37	200022	D12	REF
Q38	200043	2N3565	REF
Q39	200043	2N3565	REF
Q40	200043	2N3565	REF
Q41	200011	D69	REF
Q42	200035	D14	REF
Q43	200043	2N3565	REF
Q44	200043	2N3565	REF
R1	020308	10K 10W	1
R2	020438	5K 01SW	1
R3	020435	2K 01SW	1
R4	020434	1K 01SW	1
R5	020433	500 01SW	1
R6	020432	200 01SW	1
R7	020431	100 01SW	1
R8	020438	5K 01SW	1
R9	020429	20 01SW	1
R10	020428	10 01SW	1
R11	010336	800K 1W 5%	2
R12	010334	80K 1W 5%	REF
R13	040082	20K POT	2
R14	010112	5.36K 1W 1%	2
R15	010129	68.1K 1W 1%	1
R16	040083	50K POT	3
R17	402715	FSV ASSY	REF
R18	402715	FSV ASSY	REF
R19	010122	20.7K 1W 1%	1
R20	010258	1K 1W 1%	1
R21	000102	1K	3
R22	000302	3K	1
R23	000134	130K	2
R24	000134	130K	REF
R25	010022	40.4K 1W 1%	1
R26	000912	9.1K	1
R27	000153	15K	1
R28	000621	620	1
R29	000101	100	2
R30	000331	330	2
R31	000182	1.8K	2
R32	000820	82	2
R33	000510	51	2
R34	000510	51	REF
R35	000104	100K	2
R36	000184	180K	REF
R37	001182	8.1K 1% 2W	3
R38	000331	330	REF
R39	000122	1.2K	1
R40	000820	82	REF
R42	000221	220	2
R43	000100	10 OHM	3
R44	000100	10 OHM	REF
R45	000431	430	2
R48	000221	220	REF
R47	000101	100	REF
R48	402715	FSV ASSY	REF
R49	000431	430	REF
R50	000472	4.7K	1
R51	000182	1.8K	REF
R52		NOT USED	
R53	020308	10 OHM 10W	1
R54	040188	50K POT	1
R55	040183	20K POT	1
R56	000102	1K	REF
R57	010158	200K 1W 5%	1
R58	000201	200	4
R59	000202	2K	3
R60	040040	20K POT	1
R61	000152	1.5K	1
R62	000221	220	REF
R63	001102	5.1K 1% 2W	REF
R64	000367	3.6K	1
R65		NOT USED	
R66	000361	360	2
R67	040082	20K POT	REF
R68	010075	71.5K 1W 1%	4
R69	010075	71.5K 1W 1%	REF
R70	010077	80.6K 1W 1%	1
R71	010060	10.0K 1W 1%	1
R72	000361	360	REF
R73	040082	20K POT	3
R74	000381	380	1
R75		NOT USED	
R76		NOT USED	
R77	000201	200	REF
R78	001100	510 1.2W	1
R79	000122	1.2K	3
R80	000151	150	2
R81	000201	200	REF
R82	000201	200	REF
R83	000122	1.2K	REF
R84	000122	1.2K	REF
R85	000151	150	REF
R86	010211	4.42K 1W 1%	1
R87	010324	10.7K 1W 1%	1
R88	000027	0.2K	1
R89	000282	2K	REF
R90	000223	22K	1
R91	010070	4.99K 1W 1%	1
R92	000241	240	2
R93	010085	4.93K 1W 1%	1
R94	010112	5.36K 1W 1%	REF
R95	000511	510	2
R96	000512	5.1K	REF
R97	010075	71.5K 1W 1%	REF
R98	010075	71.5K 1W 1%	REF
R99	000183	18K	1
R100	000202	2K	REF
R101	000512	5.1K	REF
R102 R103	010113 000511	15K 1W 1% 510	1 REF
R104	001182	8.1K 1% 2W	REF
R105	000583	58K	1
R106	000181	180	2
R107	000241	240	REF
R108	001751	33 OHM 1W	2
R109	001748	10 1 2W	4
R110	001748	10 1 2W	REF
R111	001748	10 1 2W	REF
R112	001748	10 1 2W	REF
R113	001751	33 OHM 1W	REF
R114	040052	50 OHM POT	1
R115	000100	10	REF
R116	020381	1K 2W 5%	1
R117	040058	20 OHM POT	1
R118	000182	1K	REF
R119	000181	180	REF
R120	402715	FSV ASSY	REF
T1	300038	POWER XFMR	1
T2	402471	ISOLATOR XFMR ASSY	1
T2	402472	DRIVE XFMR ASSY	1
	402715	FSV ASSY	1
		PCB POST ISOLATOR	1
	430186	SCHEMATIC	REF
	452709	INSULATOR	2
	452792	BRACKET COMM MTG	1
	452343	CASE MODIFIED 870250 MYGLASS 6025	1
	452418	SHIELD CONNECTOR	1
	452413	6061 VB SWITCH AND POT MTG	1
	452414	GUARD BOX ASM'L	1
	452415	COVER GUARD BOX	1
	452416	SHIELD-PC BOARD	1
	452417	BRKT PCB STIFFNER	1
	453003	INSULATOR DECORATIVE	1
	452458	INSULATOR SHIELD	1
	452501	GUARD COVER-PWR INPUT	1
	452723	STANDOFF-COMPONENT SUPPORT	12
	452725	CLIP-COMP 560 DIA MTG	2
	452726	CLIP COMP .800 DIA MTG	2
	500002	TUBING-SHRINK .153 I.D	A/R
	500003	CABLE-BELDEN 8451	A/R
	500005	TIE CORD-NYLON	A/R
	501446	CABLE RG174 U	A/R
	524000	WIRE-24GA STR 8 COLOR	A/R
	524011	WIRE 24GA STR 9-1-1 COLOR	A/R
	524912	WIRE 24 GA STR 9-1-2 COLOR	A/R
	524913	WIRE 24 GA STR 9-1-3 COLOR	A/R
	524914	WIRE-24 GA STR 9-1-4 COLOR	A/R
	524915	WIRE-24GA STR 9-1-5 COLOR	A/R
	524916	WIRE-24GA STR 9-1-6 COLOR	A/R
	524917	WIRE-24GA STR 9-1-7 COLOR	A/R
	524918	WIRE 24GA STR 9-1-8 COLOR	A/R
	524920	WIRE-24GA STR 9-2-0 COLOR	A/R
	524921	WIRE 24GA STR 9-2-1 COLOR	A/R
	524923	WIRE-24GA STR 9-2-3 COLOR	A/R
	524924	WIRE-24 GA STR 9-2-4 COLOR	A/R
	524925	WIRE-24 GA STR 9-2-5 COLOR	A/R
	524926	WIRE-24 GA STR 9-2-6 COLOR	A/R
	524930	WIRE 24 GA STR 9-3-0 COLOR	A/R
	524931	WIRE 24GA STR 9-3-1 COLOR	A/R
	524932	WIRE-24GA STR 9-3-2 COLOR	A/R
	524934	WIRE 24GA STR 9-3-4 COLOR	A/R
	524935	WIRE-24GA STR 9-3-5 COLOR	A/R
	524936	WIRE-24GA STR 9-3-6 COLOR	A/R
	524980	WIRE-24GA STR 9 COLOR	A/R
	600016	HEAT SINK ERC TO-3 W/ 3258	4
	600032	COIL SOLDERLUG TH 1416-4	1
	600068	HEAT DISS, ERC LP5B3B	2
	600137	TERM UNINSUL .125 DIA	2
	600245	JUMPER-INSULATED	E
	600278	SWITCH ROTARY 3 POL 10 POS	1
	600249	CONN-PLUG AMPHENOL 20-4102-8P	1
	600291	CONN-PC JACK CAMB ON 3304-2-03	8
	600341	SWITCH ROTARY 2 POLE 10 POS SKT	1
	600344	CONN 8 PINS AMPH 20-4101-8P	1
	600383	TERMINAL-STUD INSUL CAMBION	3
	610019	RIVET-1/8 SEMI-TUB 9/32LG	8
	610040	GROMMET RUB 1.4 INCH I.D X 3.8	6
	610101	NUT PRESS 6-32 PEM S 632-1	8
	610111	NUT-PRESS, 4-40 PEM S-440-1	31
	610127	WASHER-SHLDR, NYL 4 SCREW	2
	610180	WASH-NYLON #4	4
	610252	STDOFF 5/8 4-40 I 1 8 LG I 1 4-40 I .06 MTG	2
	610275	CLAMP CABLE, PL BUSHING 3-441	6
	610337	STDOFF 1/4 HEX X 5/8 X 4-40 THD	2
	615015	SCREW PPH 2-56 X 5 16 STLS	4
	615042	SCREW PPH 4-40 1 4 STLS	15
	615044	SCREW PPH 4-40 X 3 8	8
	615047	SCREW PPH 4-40 3 5 8	2
	615057	SCREW PPH 6-32 X 1/4 STLS	5
	615060	SCREW PPH 4-40 X 5/16 STLS	2
	617004	NUT HEX 4-40 STD STLS	2
	617014	NUT HEX 2-56 RADIO STLS	4
	617018	NUT HEX 4-40 RADIO	2
	617075	WASHER HOT LOCK 3 STLS	4
	617077	WASHER HOT LOCK 4 STLS	22
	617079	WASHER HOT LOCK STLS	5
	617084	WASHER HOT LOCK 5/8 STLS	1
	617108	WASHER FLAT 5/8 STLS	1
	620008	TRANS P60-LARGE	19
	620010	SOLDER-63 37 BAR	A/R
	620018	HOT-PLUG FASTEN 707-000551-00	1
	620029	SOLDER-WIRE 63/37 RESIN CORE	A/R
	620050	PLUG PLASTEE 207 000241-00-0101	2
	620082	TRANS PAD ROSS 10037	4
	620271	CUP ENCAPSULATING MYGLASS #84 BLK	2

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES, ON DECIMALS ANGLES HOLE DIAMETERS
X .030 0 30' XX .020 FORMED .004 XXX .010 1 0' .001
MATERIAL

FINISH

402910	2860 V5	1	1
NEXT DWG	USED ON	NEXT ASSY	QTY REQD
APPLICATION			

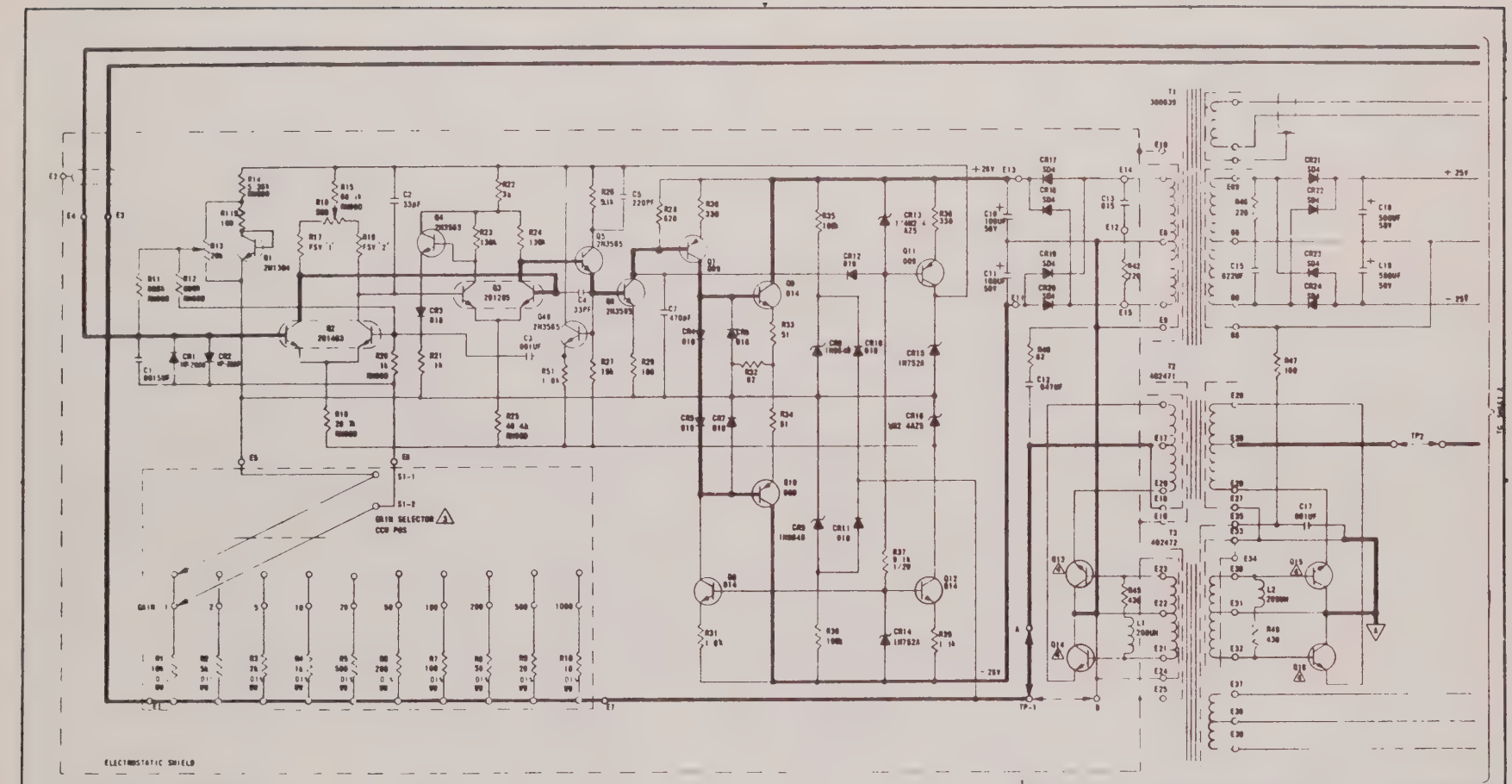
DRAWN	Tom Rhodes	7/14/69
CHECK	R Prahne	7/15/69
DESIGN	W.S. Silberg	7/16/69
MECH ENGR		
PROD ENGR	R Prahne	7/30/69

DANA LABORATORIES INC
IRVINE CALIFORNIA

P C BOARD ASSY
MODEL 2860 OPT V5

SIZE	CODE IDENT NO	DWG NO	REV
D	21793	402944	D

SCALE NONE | SHEET 5 OF 5



1. E NUMBERS DENOTE EYELETS AND CORRESPOND TO POINTS ON P C BOARD ASSY (P/N 402740)

⚠1 TRANSISTORS ARE MATCHED PAIRS 402740
Q13 AND Q14 (P/N 200072) Q15 AND Q16 (P/N 200072)
Q28 AND Q29 (P/N 200074)

⚠2 R58 (GAIN) R68 (ZERO) S1 (GAIN SELECTOR) AND S2 (RANGE-DTH SELECTOR) ARE FRONT PANEL CONTROLS

3. HIGHEST REFERENCE DESIGNATORS USED
Q87 CR67 L8 C67 R118 T3

4. ALL RESISTORS ARE 1/8 OHMS ±5% 1/4W CARBON

NOTE UNLESS OTHERWISE SPECIFIED

QTY REQD	DANA PART NUMBER	NOMENCLATURE OR DESCRIPTION	CODE IDENT	SPECIFICATION OR VENDOR P/N	ITEM NO.

LIST OF MATERIAL OR PARTS LIST

402740	2860V5		
NEXT ASSY	USED ON	NA	FA
APPLICATION		QTY REQD	

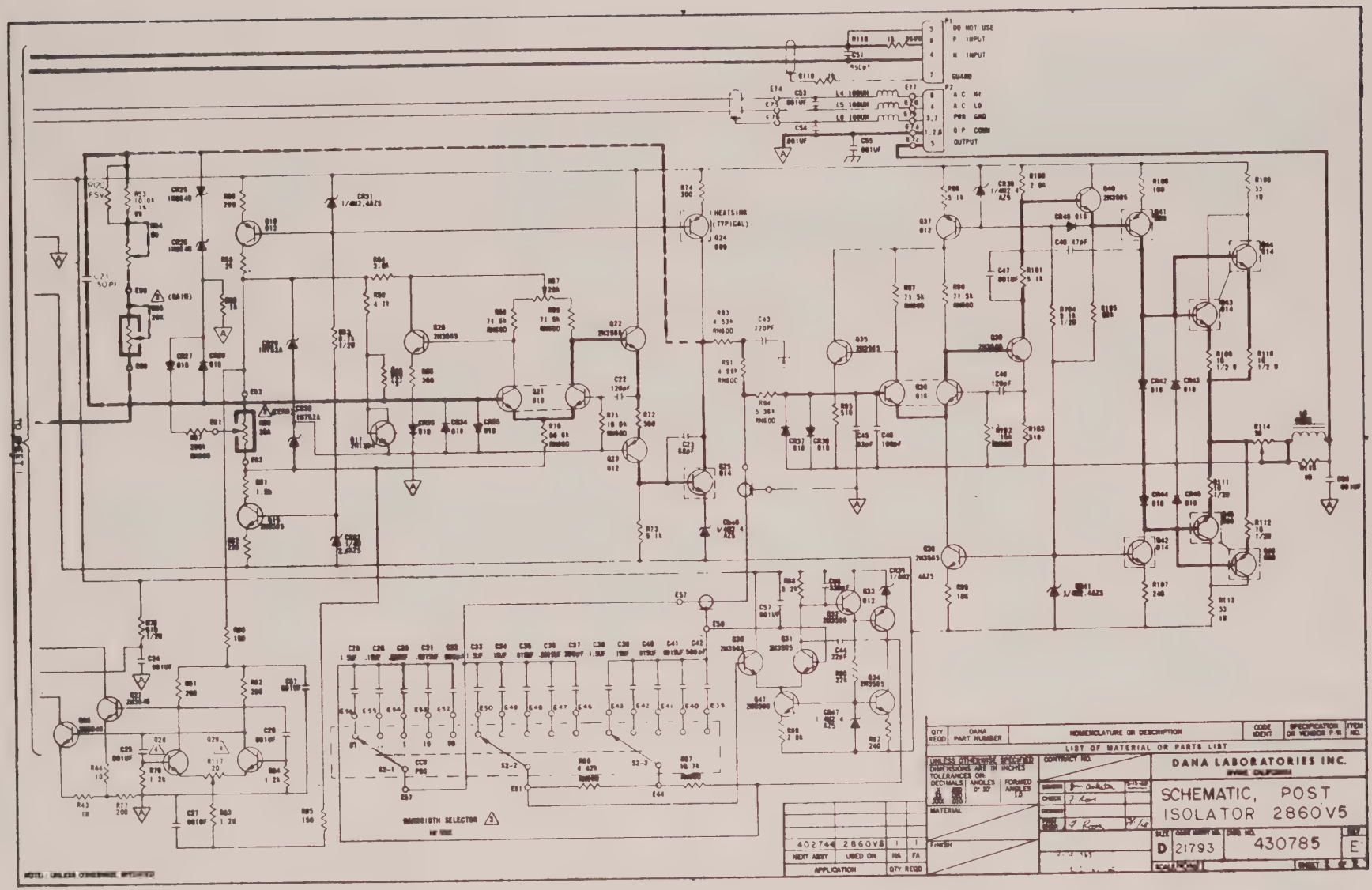
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON DECIMALS .XX ±.03 .XXX ±.010 ANGLES 0° 30' FORMED ANGLES 1.0
MATERIAL
FINISH
CONTRACT NO
DRAWN
CHECK
DESIGN
PROJ ENGR

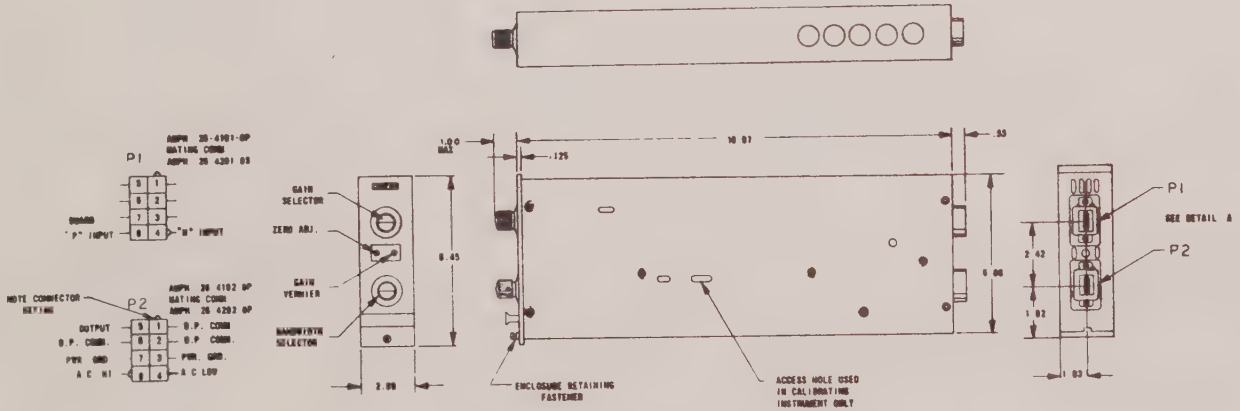
DANA LABORATORIES INC.
IRVINE, CALIFORNIA

SCHEMATIC POST ISOLATOR 2860V5

SIZE	CODE IDENT NO	DWG NO	REV
D	21793	430785	E

SCALE NONE WT SHEET 1 OF 2


P1
DO NOT USE
P INPUT
N INPUT
GUARD
P2
A C HI
A C LO
PWR GND
O P COMM
OUTPUT
HEATSINK (TYPICAL)
BANDWIDTH SELECTOR
LIST OF MATERIAL OR PARTS LIST
DANA LABORATORIES INC.
SCHEMATIC, POST ISOLATOR 2860V5
D
21793
430785
E
402744 2860V8



DETAIL 'A'

WIRING TYPICAL OF DANA COMP SET NO 402488 AND DANA MODEL 2860 1 AND 2860 2 ENCLOSURE

QTY REQD	DANA PART NUMBER	NOMENCLATURE OR DESCRIPTION	CODE IDENT	SPECIFICATION OR VENDOR P/N	ITEM NO.
		LIST OF MATERIAL OR PARTS LIST			

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON: DECIMALS .XX ±.01, .XXX ±.005; ANGLES 0° 30'; FORMED ANGLES ±1°

MATERIAL

FINISH

CONTRACT NO.

DRAWN

CHECK

DESIGN

PROJ ENGR

DEPT MGR

DANA LABORATORIES INC.
IRVINE, CALIFORNIA

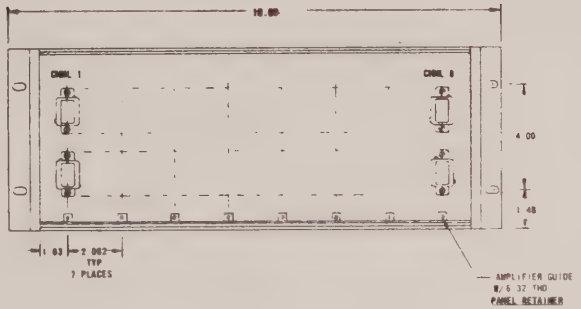
OUTLINE DIMENSIONAL-
AMPLIFIER MODEL 2860

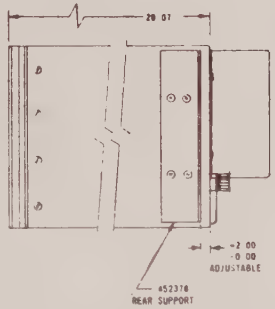
SIZE	CODE IDENT NO.	DWG NO.	REV
D	21793	452648	

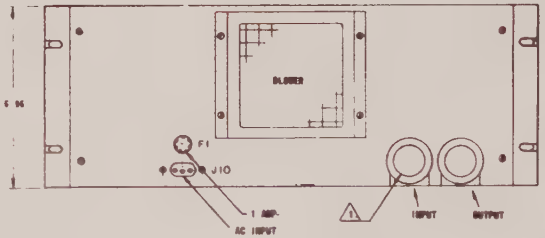
SCALE 1/2 WT SHEET 1 OF 1

NEXT ASSY	USED ON	NA	FA
402434	2860		
APPLICATION		QTY REQD	

NOTE: UNLESS OTHERWISE SPECIFIED







⚠1 ENCLOSURE WIRING PER DANA DRAWING # 430500

NOTE: UNLESS OTHERWISE SPECIFIED

Q'TY REQD	DANA PART NUMBER	NOMENCLATURE OR DESCRIPTION	CODE IDENT	SPECIFICATION OR VENDOR P/N	ITEM NO.

LIST OF MATERIAL OR PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON DECIMALS .X ±.03 .XX ±.01 .XXX ±.005 ANGLES 0 30' FORMED ANGLES 10

CONTRACT NO

MATERIAL

FINISH

DRAWN
CHECK
ENGR
PROJ ENGR
QUAL ENGR

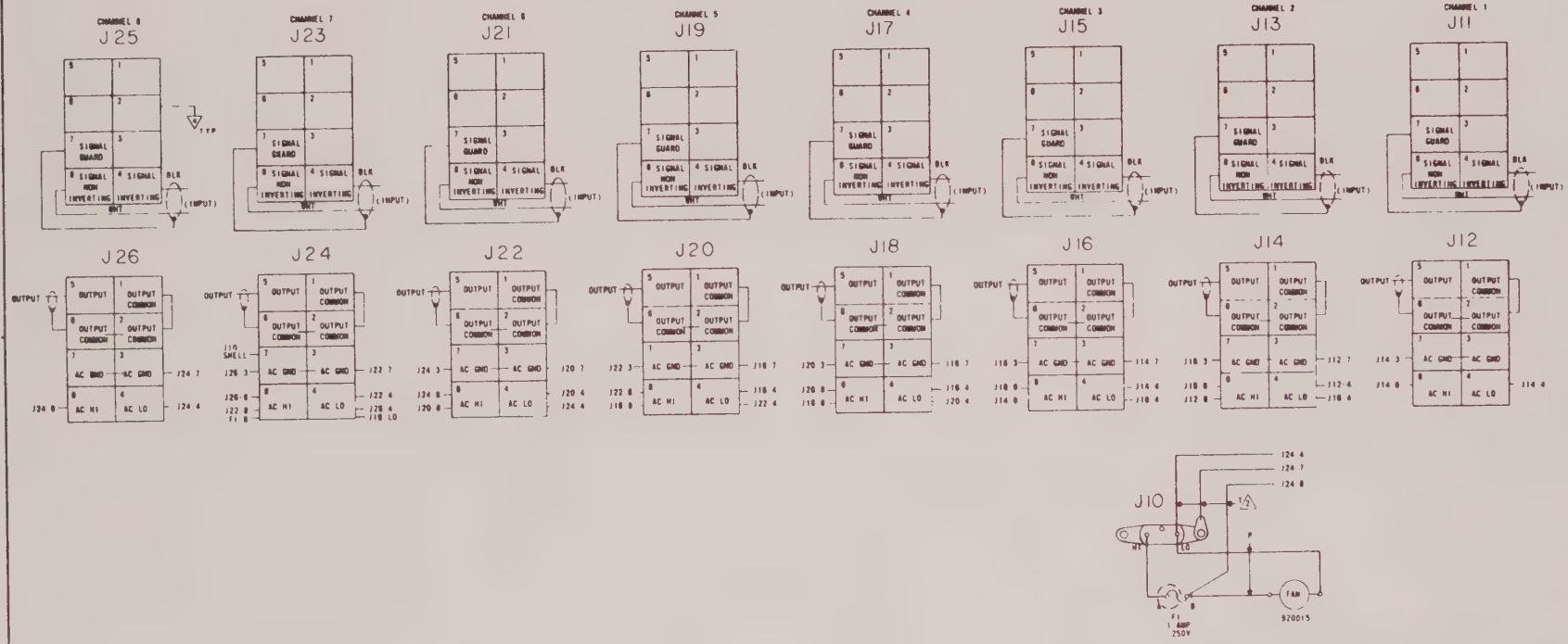
NEXT ASSY	USED ON	REF	REF
402368	2808-	NA	FA
APPLICATION		QTY REQD	

DANA LABORATORIES INC.
IRVINE, CALIFORNIA

OUTLINE DIMENSIONAL
ENCLOSURE
MODEL 2808-1.

SIZE	CODE IDENT NO	DWG NO	REV
D	21793	452402	

SCALE 1/2 | WT | SHEET 1 OF 1



QTY REQD	DANA PART NUMBER	NOMENCLATURE OR DESCRIPTION	CODE IDENT	SPECIFICATION OR VENDOR P/N	ITEM NO.
		LIST OF MATERIAL OR PARTS LIST			

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS .X ±.10 .XX ±.05 .XXX ±.010
ANGLES 0° 30'
FORMED ANGLES ±3°

MATERIAL

FINISH

CONTRACT NO

DRAWN
CHECK
QUALITY ENGR
PROJ ENGR

DANA LABORATORIES INC.
IRVINE, CALIFORNIA

WIRING DIAGRAM — 2808
ENCLOSURE, OPT 1

SIZE	CODE IDENT NO.	DWG NO.	REV
D	21793	430590	C

SCALE NONE | WT | SHEET 1 OF 1

NEXT ASSY	USED ON
402368	NA
APPLICATION	QTY REQD

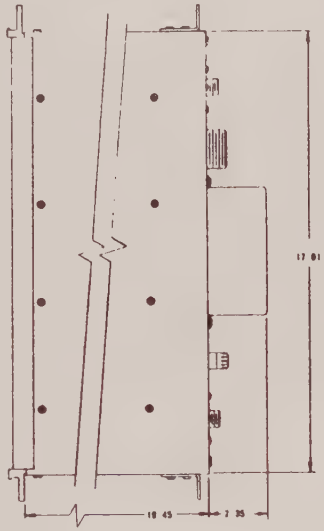
(4) PIN 2 TIED TO GROUND LUG MOUNTED ON CONNECTORS J11 J13 J15 J17 J19 J21 J23 AND J25 USING 5-24000 WIRE

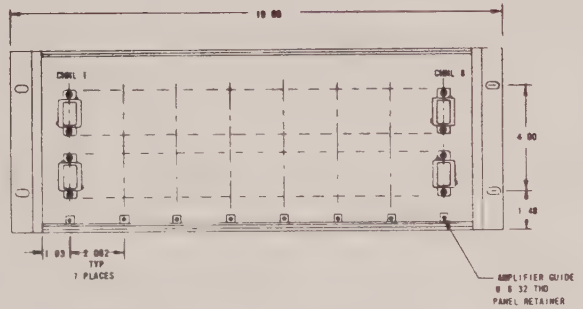
3 INTERCONNECTIONS ON CONNECTORS USING 500004 WIRE AND 501370 SLEEVING AS REQUIRED

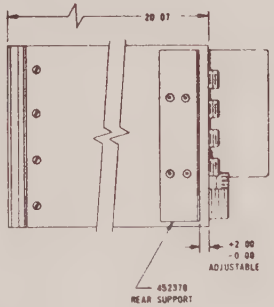
(2) ALL AC POWER WIRING TO BE TWISTED

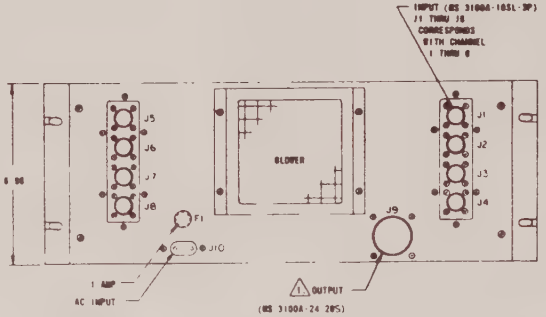
1 WIRE PER DANA WORKMANSHIP AND PROCEDURE STANDARDS

NOTE UNLESS OTHERWISE SPECIFIED









QTY REQD	DANA PART NUMBER	NOMENCLATURE OR DESCRIPTION	CODE IDENT	SPECIFICATION OR VENDOR P/N	ITEM NO.
		LIST OF MATERIAL OR PARTS LIST			

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON DECIMALS .XX ±.03 .XXX ±.010 ANGLES ±0° 30' FORMED ANGLES ±1°

CONTRACT NO —

DRAWN G WILSON 6/28/67
CHECK [illegible] 7/5/67
COG ENGR —
PROJ ENGR [illegible] 6/29/67

MATERIAL

FINISH

DANA LABORATORIES INC.
IRVINE, CALIFORNIA

OUTLINE DIMENSIONAL
ENCLOSURE
MODEL 2808-2

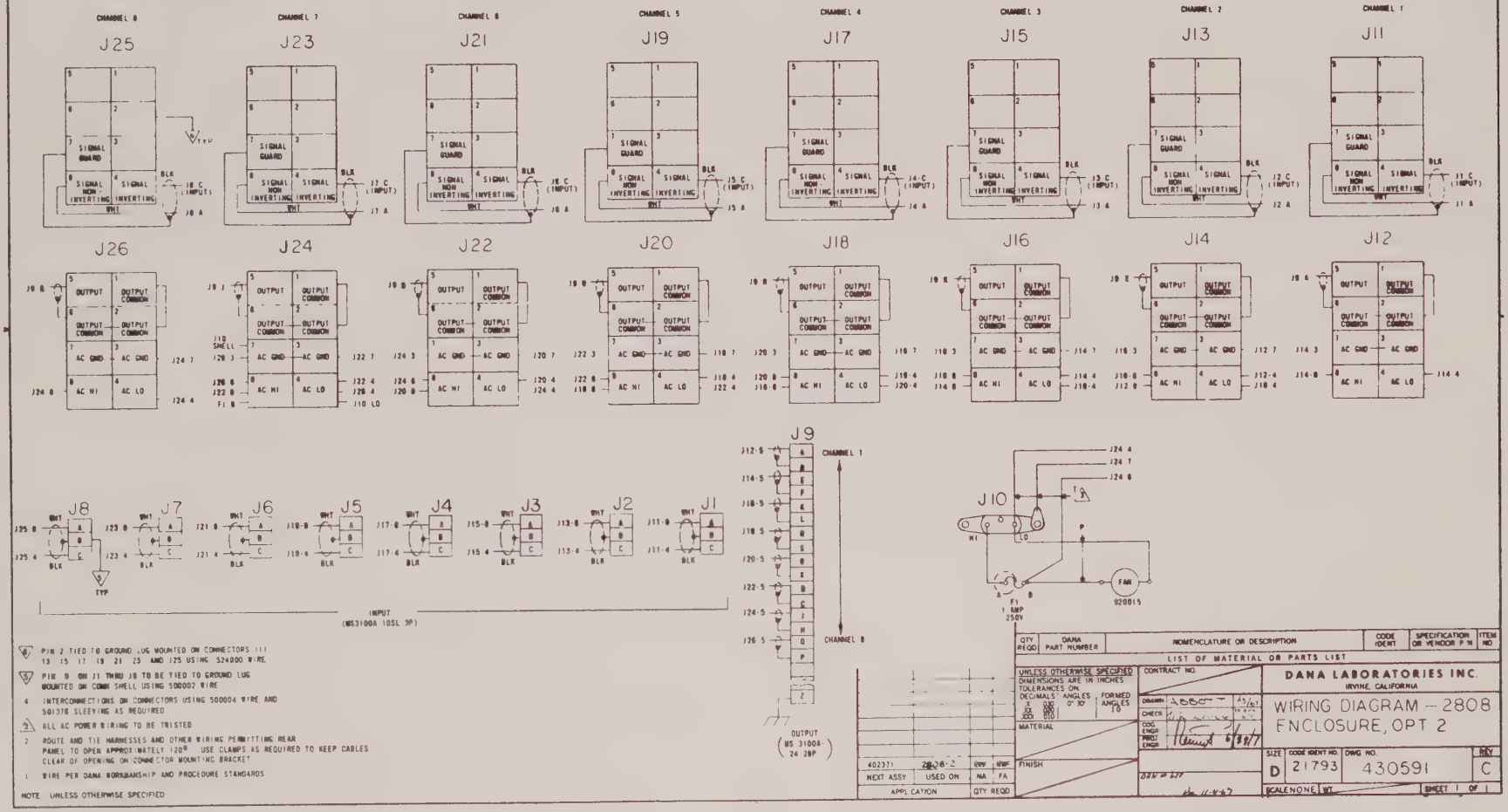
SIZE	CODE IDENT NO.	DWG NO.	REV
D	21793	452403	

SCALE 1/2 WT — SHEET 1 OF 1

402371	PROR	REF	REF
NEXT ASSY	USED ON	NA	FA
APPLICATION		QTY REQD	

⚠ ENCLOSURE WIRING PER DANA DRAWING # 430591

NOTE. UNLESS OTHERWISE SPECIFIED



(1) PIN 2 TIED TO GROUND LUG MOUNTED ON CONNECTORS J11 13 15 17 19 21 23 AND J25 USING 524000 WIRE

(2) PIN 9 ON J1 THRU J8 TO BE TIED TO GROUND LUG MOUNTED ON CONN SHELL USING 500002 WIRE

4 INTERCONNECTIONS ON CONNECTORS USING 500004 WIRE AND 501378 SLEEVING AS REQUIRED

(3) ALL AC POWER WIRING TO BE TWISTED

2 ROUTE AND TIE HARNESSES AND OTHER WIRING PERMITTING REAR PANEL TO OPEN APPROXIMATELY 120° USE CLAMPS AS REQUIRED TO KEEP CABLES CLEAR OF OPENING ON CONNECTOR MOUNTING BRACKET

L WIRE PER DANA WORKMANSHIP AND PROCEDURE STANDARDS

NOTE UNLESS OTHERWISE SPECIFIED

QTY REQD	DANA PART NUMBER	NOMENCLATURE OR DESCRIPTION	CODE IDENT	SPECIFICATION OR VENDOR P/N	ITEM NO

LIST OF MATERIAL OR PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON: DECIMALS: .X ±.030, .XX ±.010, .XXX ±.005; ANGLES 0° 30'; FORMED ANGLES ±0

MATERIAL

FINISH

CONTRACT NO.

DRAWN A. BOOT 12/6/67

CHECK

COG. ENGR

PROJ. ENGR Clement 6/28/67

DANA LABORATORIES INC.
IRVINE, CALIFORNIA

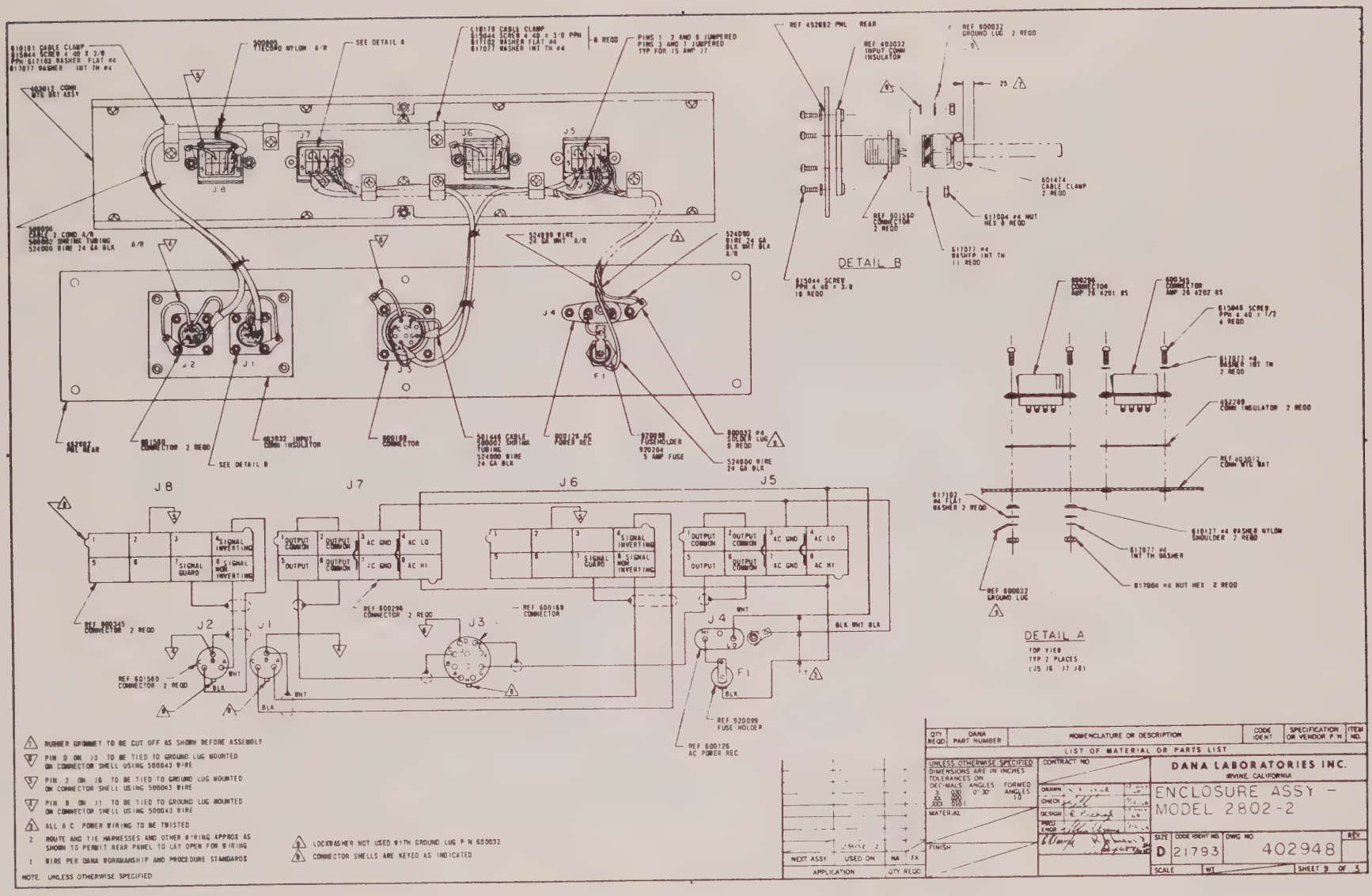
WIRING DIAGRAM — 2808 ENCLOSURE, OPT 2

SIZE	CODE IDENT NO.	DWG NO.	REV
D	21793	430591	C

SCALE NONE WT SHEET 1 OF 1

402371	2808-2	REV	ENG
NEXT ASSY	USED ON	NA	FA
APPLICATION		QTY REQD	

DATE 11-6-67



△ RUBBER GROMMET TO BE CUT OFF AS SHOWN BEFORE ASSEMBLY

▽ PIN 8 ON J3 TO BE TIED TO GROUND LUG MOUNTED ON CONNECTOR SHELL USING 500043 WIRE

▽ PIN 2 ON J6 TO BE TIED TO GROUND LUG MOUNTED ON CONNECTOR SHELL USING 500043 WIRE

▽ PIN 8 ON J1 TO BE TIED TO GROUND LUG MOUNTED ON CONNECTOR SHELL USING 500043 WIRE

△ ALL A C POWER WIRING TO BE TWISTED

2 ROUTE AND TIE HARNESSES AND OTHER WIRING APPROX AS SHOWN TO PERMIT REAR PANEL TO LAY OPEN FOR WIRING

1 WIRE PER DANA WORKMANSHIP AND PROCEDURE STANDARDS

NOTE. UNLESS OTHERWISE SPECIFIED

△ LOCKWASHER NOT USED WITH GROUND LUG P/N 600032

△ CONNECTOR SHELLS ARE KEYED AS INDICATED

NEXT ASSY	USED ON	NA	FA
APPLICATION		QTY REQD	

QTY REQD	DANA PART NUMBER	NOMENCLATURE OR DESCRIPTION	CODE IDENT	SPECIFICATION OR VENDOR P/N	ITEM NO.

LIST OF MATERIAL OR PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS ANGLES FORMED .X .030 0° 30' ANGLES .XX .010 TO .XXX .010

MATERIAL

FINISH

CONTRACT NO

DRAWN

CHECK

DESIGN

PROJ ENGR

DANA LABORATORIES INC.
IRVINE, CALIFORNIA

ENCLOSURE ASSY - MODEL 2802-2

SIZE	CODE IDENT NO.	DWG NO	REV
D	21793	402948	

SCALE WT SHEET 3 OF 5

PARTS LIST

ASSEMBLY 402943 **PC BOARD ASSY-MODEL 2860 OPT V4**

REF. DESIG.	PART NO.	DESCRIPTION			
CR01	211083	DIODE SILICO	018	1	DANA 211083
CR02	211083	DIODE SILICO	018	1	DANA 211083
CR03	211083	DIODE SILICO	018	1	DANA 211083
CR04	211083	DIODE SILICO	018	1	DANA 211083
CR05	211083	DIODE SILICO	018	1	DANA 211083
CR06	211083	DIODE SILICO	018	1	DANA 211083
CR07	211083	DIODE SILICO	018	1	DANA 211083
CR08	220016	DIODE SILICO ZENER	1N964B		MOTOROLA 1N964B
CR09	220016	DIODE SILICO ZENER	1N964B		MOTOROLA 1N964B
CR10	211083	DIODE SILICO	018	1	DANA 211083
CR11	211083	DIODE SILICO	018	1	DANA 211083
CR12	211083	DIODE SILICO	018	1	DANA 211083
CR13	220030	DIODE SILICO ZENER	1/4M2.4AZ5		MOTOROLA 1/4M2.4AZ5
CR14	220019	DIODE SILICO ZENER	1N752A		MOTOROLA 1N752A
CR15	220019	DIODE SILICO ZENER	1N752A		MOTOROLA 1N752A
CR16	220030	DIODE SILICO ZENER	1/4M2.4AZ5		MOTOROLA 1/4M2.4AZ5
CR17	210004	DIODE SILICO	SD4		DIODES IN SD4
CR18	210004	DIODE SILICO	SD4		DIODES IN SD4
CR19	210004	DIODE SILICO	SD4		DIODES IN SD4
CR20	210004	DIODE SILICO	SD4		DIODES IN SD4
CR21	210004	DIODE SILICO	SD4		DIODES IN SD4
CR22	210004	DIODE SILICO	SD4		DIODES IN SD4
CR23	210004	DIODE SILICO	SD4		DIODES IN SD4
CR24	210004	DIODE SILICO	SD4		DIODES IN SD4
CR25	220016	DIODE SILICO ZENER	1N964B		MOTOROLA 1N964B
CR26	220016	DIODE SILICO ZENER	1N964B		MOTOROLA 1N964B
CR27	211083	DIODE SILICO	018	1	DANA 211083
CR28	211083	DIODE SILICO	018	1	DANA 211083
CR29	220019	DIODE SILICO ZENER	1N752A		MOTOROLA 1N752A
CR30	220019	DIODE SILICO ZENER	1N752A		MOTOROLA 1N752A
CR31	220030	DIODE SILICO ZENER	1/4M2.4AZ5		MOTOROLA 1/4M2.4AZ5
CR32	220030	DIODE SILICO ZENER	1/4M2.4AZ5		MOTOROLA 1/4M2.4AZ5
CR33	211083	DIODE SILICO	018	1	DANA 211083
CR34	211083	DIODE SILICO	018	1	DANA 211083
CR35	211083	DIODE SILICO	018	1	DANA 211083
CR36	220030	DIODE SILICO ZENER	1/4M2.4AZ5		MOTOROLA 1/4M2.4AZ5
CR37	211083	DIODE SILICO	018	1	DANA 211083
CR38	211083	DIODE SILICO	018	1	DANA 211083

PARTS LIST

ASSEMBLY 402943 **P C BOARD ASSY-MODEL 2860 OPT V4**

REF. DESIG.	PART NO.	DESCRIPTION						
CR39	220030	DIODE SILICO ZENER 1/4M2.4AZ5					MOTOROLA	1/4M2.4AZ5
CR40	211083	DIODE SILICO 018				1	DANA	211083
CR41	220030	DIODE SILICO ZENER 1/4M2.4AZ5					MOTOROLA	1/4M2.4AZ5
CR42	211083	DIODE SILICO 018				1	DANA	211083
CR43	211083	DIODE SILICO 018				1	DANA	211083
CR44	211083	DIODE SILICO 018				1	DANA	211083
CR45	211083	DIODE SILICO 018				1	DANA	211083
CR46	220030	DIODE SILICO ZENER 1/4M2.4AZ5					MOTOROLA	1/4M2.4AZ5
CR47	220030	DIODE SILICO ZENER 1/4M2.4AZ5					MOTOROLA	1/4M2.4AZ5
C01	121473	CAP	MYLAR	.0015 MFD	100 V	10%1	CDE	WMF1S47
C02	100012	CAP	CERAM	33 PFD	500 V	10%	AEROVOX	TCD-N750
C03	101174	CAP	CERAM	.001 MFD	500 V	10%1	AEROVOX	SCD3X5F
C04	100012	CAP	CERAM	33 PFD	500 V	10%	AEROVOX	TCD-N750
C05	101175	CAP	CERAM	220 PFD	500 V	10%1	AEROVOX	SCD1X5F
C07	101641	CAP	CERAM	470 PFD	500 V	10%1	AEROVOX	SCD1X5F
C10	110061	CAP	ELECT	100 MFD	50 V		SPRAGUE	39D107G050EJ4
C11	110061	CAP	ELECT	100 MFD	50 V		SPRAGUE	39D107G050EJ4
C12	121093	CAP	MYLAR	.047 MFD	100 V	10%1	CDE	WMF1S47
C13	120131	CAP	MYLAR	.015 MFD	100 V	5%	IMB	XT2B153J
C15	121468	CAP	MYLAR	.022 MFD	100 V	10%1	CDE	WMF1S22
C17	101174	CAP	CERAM	.001 MFD	500 V	10%1	AEROVOX	SCD3X5F
C18	110062	CAP	ELECT	500 MFD	50 V		SPRAGUE	39D507G050L4
C19	110062	CAP	ELECT	500 MFD	50 V		SPRAGUE	39D507G050L4
C21	101642	CAP	CERAM	150 PFD	500 V	10%1	AEROVOX	SCD2X5F
C22	100018	CAP	CERAM	120 PFD	1000 V	10%	AEROVOX	ETCD
C23	100010	CAP	CERAM	68 PFD	500 V	10%	AERVOX	TCD-N750
C24	101174	CAP	CERAM	.001 MFD	500 V	10%1	AEROVOX	SCD3X5F
C25	101174	CAP	CERAM	.001 MFD	500 V	10%1	AEROVOX	SCD3X5F
C26	101174	CAP	CERAM	.001 MFD	500 V	10%1	AEROVOX	SCD3X5F
C27	101174	CAP	CERAM	.001 MFD	500 V	10%1	AEROVOX	SCD3X5F
C28	120129	CAP	MYLAR	1.5 MFD	100 V	5%	IMB	XT2B155J
C29	120130	CAP	MYLAR	.15 MFD	100 V	5%	IMB	XT2B154J
C30	120131	CAP	MYLAR	.015 MFD	100 V	5%	IMB	XT2B153J
C31	130051	CAP	GLASS	.0015 MFD		5%	ELMENCO	CM-20-E-152J
C32	130056	CAP	GLASS	200 PFD		5%	OHMITE	CM15F201J
C33	120129	CAP	MYLAR	1.5 MFD	100 V	5%	IMB	XT2B155J
C34	120130	CAP	MYLAR	.15 MFD	100 V	5%	IMB	XT2B154J
C35	120131	CAP	MYLAR	.015 MFD	100 V	5%	IMB	XT2B153J

PARTS LIST

ASSEMBLY 402943 **P C BOARD ASSY-MODEL 2860 OPT V4**

REF. DESIG.	PART NO.	DESCRIPTION						
C36	130051	CAP	GLASS	.0015 MFD		5%	ELMENCO	CM-20-E-152J
C37	130056	CAP	GLASS	200 PFD		5%	OHMITE	CM15E201J
C38	120129	CAP	MYLAR	1.5 MFD	100 V	5%	IMB	XT2B155J
C39	120130	CAP	MYLAR	.15 MFD	100 V	5%	IMB	XT2B154J
C40	120131	CAP	MYLAR	.015 MFD	100 V	5%	IMB	XT2B153J
C41	130051	CAP	GLASS	.0015 MFD		5%	ELMENCO	CM-20-E-152J
C42	130057	CAP	GLASS	560 PFD		5%	OHMITE	CM15E561J
C43	101175	CAP	CERAM	220 PFD	500 V	10%1	AEROVOX	SCD1X5F
C44	100005	CAP	CERAM	22 PFD	500 V	10%	AEROVOX	TCD-N750
C45	100012	CAP	CERAM	33 PFD	500 V	10%	AEROVOX	TCD-N750
C46	101145	CAP	CERAM	100 PFD	500 V	10%1	AEROVOX	SCD1X5F
C47	101174	CAP	CERAM	.001 MFD	500 V	10%1	AEROVOX	SCD3X5F
C48	100018	CAP	CERAM	120 PFD	1000 V	10%	AEROVOX	ETCD
C49	101182	CAP	CERAM	47 PFD	500 V	10%1	AEROVOX	TCD-N750
C50	101174	CAP	CERAM	.001 MFD	500 V	10%1	AEROVOX	SCD3X5F
C51	101099	CAP	CERAM	680 PFD	500 V	10%1	AEROVOX	SCD2X5F
C53	101174	CAP	CERAM	.001 MFD	500 V	10%1	AEROVOX	SCD3X5F
C54	101174	CAP	CERAM	.001 MFD	500 V	10%1	AEROVOX	SCD3X5F
C55	101174	CAP	CERAM	.001 MFD	500 V	10%1	AEROVOX	SCD3X5F
C56	101098	CAP	CERAM	330 PFD	500 V	10%1	AEROVOX	SCD1X5F
C57	101174	CAP	CERAM	.001 MFD	500 V	10%1	AEROVOX	SCD3X5F
L01	310034	CHOKE		200 MH			MILLER	9210-90
L02	310034	CHOKE		200 MH			MILLER	9210-90
L03	402470	**CHOKE OUTPUT 30 MH**					**DANA**	**402470**
L04	310033	CHOKE		100 MH			MILLER	9210-76
L05	310033	CHOKE		100 MH			MILLER	9210-76
L06	310033	CHOKE		100 MH			MILLER	9210-76
Q01	201084	TRANS GERMAN PNP		2N1304		1	TI	2N1304
Q02	402715	ASSY		FSV 2860			DANA	402715
Q03	201285	TRANS DUAL NPN		016S			DANA	201285
Q04	200043	TRANS SILICO NPN		2N3565			FAIRCHILD	2N3565
Q05	200043	TRANS SILICO NPN		2N3565			FAIRCHILD	2N3565
Q06	200043	TRANS SILICO NPN		2N3565			FAIRCHILD	2N3565
Q07	200011	TRANS SILICO PNP		009			DANA	200011
Q08	200035	TRANS SILICO NPN		014			DANA	200035
Q09	200035	TRANS SILICO NPN		014			DANA	200035
Q10	200011	TRANS SILICO PNP		009			DANA	200011
Q11	200011	TRANS SILICO PNP		009			DANA	200011

PARTS LIST

ASSEMBLY 402943 **P C BOARD ASSY-MODEL 2860 OPT V4**

REF. DESIG.	PART NO.	DESCRIPTION				
Q12	200035	TRANS SILICO NPN	014		DANA	200035
Q13	200072	TRANS SILICO DUAL FSV			DANA	200072
Q14	200072	TRANS SILICO DUAL FSV			DANA	200072
Q15	200072	TRANS SILICO DUAL FSV			DANA	200072
Q16	200072	TRANS SILICO DUAL FSV			DANA	200072
Q17	201084	TRANS GERMAN PNP	2N1304	1	TI	2N1304
Q18	200022	TRANS SILICO PNP	012		DANA	200022
Q19	200043	TRANS SILICO NPN	2N3565		FAIRCHILD	2N3565
Q20	200043	TRANS SILICO NPN	2N3565		FAIRCHILD	2N3565
Q21	200040	TRANS SILICO NPN	016		DANA	200040
Q22	200043	TRANS SILICO NPN	2N3565		FAIRCHILD	2N3565
Q23	200022	TRANS SILICO PNP	012		DANA	200022
Q24	200011	TRANS SILICO PNP	009		DANA	200011
Q25	200035	TRANS SILICO NPN	014		DANA	200035
Q26	200037	TRANS SILICO NPN	2N3646		FAIRCHILD	2N3646
Q27	200037	TRANS SILICO NPN	2N3646		FAIRCHILD	2N3646
Q28	200074	TRANS SILICO DUAL FSV			DANA	200074
Q29	200074	TRANS SILICO DUAL FSV			DANA	200074
Q30	200043	TRANS SILICO NPN	2N3565		FAIRCHILD	2N3565
Q31	200043	TRANS SILICO NPN	2N3565		FAIRCHILD	2N3565
Q32	200043	TRANS SILICO NPN	2N3565		FAIRCHILD	2N3565
Q33	200022	TRANS SILICO PNP	012		DANA	200022
Q34	200043	TRANS SILICO NPN	2N3565		FAIRCHILD	2N3565
Q35	200043	TRANS SILICO NPN	2N3565		FAIRCHILD	2N3565
Q36	200040	TRANS SILICO NPN	016		DANA	200040
Q37	200022	TRANS SILICO PNP	012		DANA	200022
Q38	200043	TRANS SILICO NPN	2N3565		FAIRCHILD	2N3565
Q39	200043	TRANS SILICO NPN	2N3565		FAIRCHILD	2N3565
Q40	200043	TRANS SILICO NPN	2N3565		FAIRCHILD	2N3565
Q41	200011	TRANS SILICO PNP	009		DANA	200011
Q42	200035	TRANS SILICO NPN	014		DANA	200035
Q43	200035	TRANS SILICO NPN	014		DANA	200035
Q44	200035	TRANS SILICO NPN	014		DANA	200035
Q45	200011	TRANS SILICO PNP	009		DANA	200011
Q46	200011	TRANS SILICO PNP	009		DANA	200011
Q47	200043	TRANS SILICO NPN	2N3565		FAIRCHILD	2N3565
Q48	200043	TRANS SILICO NPN	2N3565		FAIRCHILD	2N3565

PARTS LIST

ASSEMBLY 402943 **P C BOARD ASSY-MODEL 2860 OPT V4**

REF. DESIG.	PART NO.	DESCRIPTION							
R01	020386	RES	WW	10 K	.1%	1/8 W	JORDAN	J11	
R02	020141	RES	WW	5 K	.1%		JORDAN	J11	
R03	020385	RES	WW	2 K	.1%		JORDAN	J11	
R04	020139	RES	WW	1 K	.1%	1/8 W	KELVIN	J-11	
R05	020240	RES	WW	500 OHM	.1%	1/8 W	JORDAN	J-11	
R06	020202	RES	WW	200 OHM	.1%	1/8 W	JORDAN	J-11	
R07	020384	RES	WW	100 OHM	.1%		JORDAN	J11	
R08	020335	RES	WW	50 OHM	.1%	1/8 W	JORDAN	J-11	
R09	020383	RES	WW	20 OHM	.1%		JORDAN	J11	
R10	020382	RES	WW	10 OHM	.1%		JORDAN	J11	
R11	010336	RES	METAL	806 K	1%		CORNING	RN60D9083F	
R12	010336	RES	METAL	806 K	1%		CORNING	RN60D9083F	
R13	040092	RES	VARI	20 K			SPECTRO	50-3-1-203	
R14	010112	RES	METAL	5.36 K	1%	1/4 W1	ELECTRA	RN60D5361F	
R15	010120	RES	METAL	68.1 K	1%	1/4 W	ELECTRA	RN60D6812F	
R16	040093	RES	VARI	500 OHM			SPECTRO	50-3-1-501	
R17	402715	ASSY		FSV 2860			DANA	402715	
R18	402715	ASSY		FSV 2860			DANA	402715	
R19	010122	RES	METAL	28.7 K	1%	1/4 W	ELECTRA	RN60B2872F	
R20	010259	RES	METAL	1 K	1%	1/4 W	ELECTRA	RN60C1001F	
R21	000102	RES	CARBON	1 K	5%	1/4 W1	OHMITE	RC07GF102J	
R22	000302	RES	CARBON	3 K	5%	1/4 W1	OHMITE	RC07GF302J	
R23	000134	RES	CARBON	130 K	5%	1/4 W	OHMITE	RC07GF134J	
R24	000134	RES	CARBON	130 K	5%	1/4 W	OHMITE	RC07GF134J	
R25	010022	RES	METAL	46.4 K	1%	1/4 W	ELECTRA	RN60D4642F	
R26	000183	RES	CARBON	18 K	5%	1/4 W1	OHMITE	RC07GF183J	
R27	000153	RES	CARBON	15 K	5%	1/4 W1	OHMITE	RC07GF153J	
R28	000621	RES	CARBON	620 OHM	5%	1/4 W1	OHMITE	RC07GF621J	
R29	000101	RES	CARBON	100 OHM	5%	1/4 W1	OHMITE	RC07GF101J	
R30	000331	RES	CARBON	330 OHM	5%	1/4 W1	OHMITE	RC07GF331J	
R31	000182	RES	CARBON	1.8 K	5%	1/4 W1	OHMITE	RC07GF182J	
R32	000820	RES	CARBON	82 OHM	5%	1/4 W	OHMITE	RC07GF820J	
R33	000510	RES	CARBON	51 OHM	5%	1/4 W1	OHMITE	RC07GF510J	
R34	000510	RES	CARBON	51 OHM	5%	1/4 W1	OHMITE	RC07GF510J	
R35	000104	RES	CARBON	100 K	5%	1/4 W1	OHMITE	RC07GF104J	
R36	000104	RES	CARBON	100 K	5%	1/4 W1	OHMITE	RC07GF104J	
R37	001102	RES	CARBON	9.1 K	5%	1/2 W	OHMITE	RC20GF912J	
R38	000331	RES	CARBON	330 OHM	5%	1/4 W1	OHMITE	RC07GF331J	

PARTS LIST

ASSEMBLY 402943 **P C BOARD ASSY-MODEL 2860 OPT V4**

REF. DESIG.	PART NO.	DESCRIPTION							
R39	000112	RES	CARBON	1.1 K	5%	1/4 W		OHMITE	RC07GF112J
R40	000820	RES	CARBON	82 OHM	5%	1/4 W		OHMITE	RC07GF820J
R42	000221	RES	CARBON	220 OHM	5%	1/4 W1		OHMITE	RC07GF221J
R43	000100	RES	CARBON	10 OHM	5%	1/4 W1		OHMITE	RC07GF100J
R44	000100	RES	CARBON	10 OHM	5%	1/4 W1		OHMITE	RC07GF100J
R45	000431	RES	CARBON	430 OHM	5%	1/4 W1		OHMITE	RC07GF431J
R46	000221	RES	CARBON	220 OHM	5%	1/4 W1		OHMITE	RC07GF221J
R47	000101	RES	CARBON	100 OHM	5%	1/4 W1		OHMITE	RC07GF101J
R48	402715	ASSY		FSV 2860				DANA	402715
R49	000431	RES	CARBON	430 OHM	5%	1/4 W1		OHMITE	RC07GF431J
R50	000472	RES	CARBON	4.7 K	5%	1/4 W1		OHMITE	RC07GF472J
R51	000182	RES	CARBON	1.8 K	5%	1/4 W1		OHMITE	RC07GF182J
R53	020419	RES	WW	9.75 K	.1%			JORDAN	J11
R54	040093	RES	VARI	500 OHM				SPECTRO	50-3-1-501
R55	040103	RES	VARI	20 K	5%			IRC	
R56	000102	RES	CARBON	1 K	5%	1/4 W1		OHMITE	RC07GF102J
R57	010158	RES	METAL	200 K	1%	1/4 W1		ELECTRA	RN60D2003F
R58	000201	RES	CARBON	200 OHM	5%	1/4 W1		OHMITE	RC07GF201J
R59	000202	RES	CARBON	2 K	5%	1/4 W1		OHMITE	RC07GF202J
R60	040040	RES	VARI	20 K	10%	1/4 W		BOURNS	271-1-203 M
R61	000152	RES	CARBON	1.5 K	5%	1/4 W1		OHMITE	RC07GF152J
R62	000221	RES	CARBON	220 OHM	5%	1/4 W1		OHMITE	RC07GF221J
R63	001102	RES	CARBON	9.1 K	5%	1/2 W		OHMITE	RC20GF912J
R64	000362	RES	CARBON	3.6 K	5%	1/4 W1		OHMITE	RC07GF362J
R66	000361	RES	CARBON	360 OHM	5%	1/4 W		OHMITE	RC07GF361J
R67	040092	RES	VARI	20 K				SPECTRO	50-3-1-203
R68	010075	RES	METAL	71.5 K	1%	1/4 W		ELECTRA	RN60D7152F
R69	010075	RES	METAL	71.5 K	1%	1/4 W		ELECTRA	RN60D7152F
R70	010077	RES	METAL	80.6 K	1%	1/4 W		ELECTRA	RN60D8062F
R71	010060	RES	METAL	10 K	1%	1/4 W		ELECTRA	RN60D1002F
R72	000361	RES	CARBON	360 OHM	5%	1/4 W		OHMITE	RC07GF361J
R73	000512	RES	CARBON	5.1 K	5%	1/4 W1		OHMITE	RC07GF512J
R74	000301	RES	CARBON	300 OHM	5%	1/4 W		OHMITE	RC07GF301J
R77	000201	RES	CARBON	200 OHM	5%	1/4 W1		OHMITE	RC07GF201J
R78	001706	RES	CARBON	510 OHM	5%	1/2 W1		OHMITE	RC20GF511J
R79	000122	RES	CARBON	1.2 K	5%	1/4 W1		OHMITE	RC07GF122J
R80	000151	RES	CARBON	150 OHM	5%	1/4 W1		OHMITE	RC07GF151J

PARTS LIST

ASSEMBLY 402943 **P C BOARD ASSY-MODEL 2860 OPT V4**

REF. DESIG.	PART NO.	DESCRIPTION						
R81	000201	RES	CARBON	200 OHM	5%	1/4 W1	OHMITE	RC07GF201J
R82	000201	RES	CARBON	200 OHM	5%	1/4 W1	OHMITE	RC07GF201J
R83	000122	RES	CARBON	1.2 K	5%	1/4 W1	OHMITE	RC07GF122J
R84	000122	RES	CARBON	1.2 K	5%	1/4 W1	OHMITE	RC07GF122J
R85	000151	RES	CARBON	150 OHM	5%	1/4 W1	OHMITE	RC07GF151J
R86	010211	RES	METAL	4.42 K	1%		CORNING	RN60D
R87	010324	RES	METAL	10.7 K	1%		CORNING	RN60D1072F
R88	000822	RES	CARBON	8.2 K	5%	1/4 W1	OHMITE	RC07GF822J
R89	000202	RES	CARBON	2 K	5%	1/4 W1	OHMITE	RC07GF202J
R90	000223	RES	CARBON	22 K	5%	1/4 W	OHMITE	RC07GF223J
R91	010020	RES	METAL	4.99 K	1%	1/4 W	ELECTRA	RN60D4991F
R92	000241	RES	CARBON	240 OHM	5%	1/4 W1	OHMITE	RC07GF241J
R93	010085	RES	METAL	4.53 K	1%	1/4 W	ELECTRA	RN60D4531F
R94	010112	RES	METAL	5.36 K	1%	1/4 W1	ELECTRA	RN60D5361F
R95	000511	RES	CARBON	510 OHM	5%	1/4 W1	OHMITE	RC07GF511J
R96	000512	RES	CARBON	5.1 K	5%	1/4 W1	OHMITE	RC07GF512J
R97	010075	RES	METAL	71.5 K	1%	1/4 W	ELECTRA	RN60D7152F
R98	010075	RES	METAL	71.5 K	1%	1/4 W	ELECTRA	RN60D7152F
R99	000163	RES	CARBON	16 K	5%	1/4 W1	OHMITE	RC07GF163J
R100	000202	RES	CARBON	2 K	5%	1/4 W1	OHMITE	RC07GF202J
R101	000512	RES	CARBON	5.1 K	5%	1/4 W1	OHMITE	RC07GF512J
R102	010113	RES	METAL	15 K	1%	1/4 W	ELECTRA	RN60D1502F
R103	000511	RES	CARBON	510 OHM	5%	1/4 W1	OHMITE	RC07GF511J
R104	001102	RES	CARBON	9.1 K	5%	1/2 W	OHMITE	RC20GF912J
R105	000563	RES	CARBON	56 K	5%	1/4 W	OHMITE	RC07GF563J
R106	000161	RES	CARBON	160 OHM	5%	1/4 W	OHMITE	RC07GF161J
R107	000241	RES	CARBON	240 OHM	5%	1/4 W1	OHMITE	RC07GF241J
R108	001751	RES	CARBON	33 OHM	5%	1/2 W	OHMITE	RC20GF330J
R109	001748	RES	CARBON	16 OHM	5%	1/2 W	OHMITE	RC20GF160J
R110	001748	RES	CARBON	16 OHM	5%	1/2 W	OHMITE	RC20GF160J
R111	001748	RES	CARBON	16 OHM	5%	1/2 W	OHMITE	RC20GF160J
R112	001748	RES	CARBON	16 OHM	5%	1/2 W	OHMITE	RC20GF160J
R113	001751	RES	CARBON	33 OHM	5%	1/2 W	OHMITE	RC20GF330J
R114	040052	RES	VARI	50 OHM	10%	1.5 W	CTS	110
R115	000100	RES	CARBON	10 OHM	5%	1/4 W1	OHMITE	RC07GF100J
R116	020381	RES	WW	1 K	.3%	3 W	CF	M18
R117	040098	RES	VARI	20 K	10%		BECKMAN	62PR20K
R118	000102	RES	CARBON	1 K	5%	1/4 W1	OHMITE	RC07GF102J

PARTS LIST

ASSEMBLY 402943 **P C BOARD ASSY-MODEL 2860 OPT V4**

REF. DESIG.	PART NO.	DESCRIPTION							
R119	000161	RES	CARBON	160	OHM	5%	1/4 W	OHMITE	RC07GF161J

PARTS LIST

ASSEMBLY 402944 **P C BOARD ASSY. MODEL 2860 OPT V5**

REF. DESIG.	PART NO.	DESCRIPTION			
CR01	211083	DIODE SILICO	018	1	DANA 211083
CR02	211083	DIODE SILICO	018	1	DANA 211083
CR03	211083	DIODE SILICO	018	1	DANA 211083
CR04	211083	DIODE SILICO	018	1	DANA 211083
CR05	211083	DIODE SILICO	018	1	DANA 211083
CR06	211083	DIODE SILICO	018	1	DANA 211083
CR07	211083	DIODE SILICO	018	1	DANA 211083
CR08	220016	DIODE SILICO ZENER	1N964B		MOTOROLA 1N964B
CR09	220016	DIODE SILICO ZENER	1N964B		MOTOROLA 1N964B
CR10	211083	DIODE SILICO	018	1	DANA 211083
CR11	211083	DIODE SILICO	018	1	DANA 211083
CR12	211083	DIODE SILICO	018	1	DANA 211083
CR13	220030	DIODE SILICO ZENER	1/4M2.4AZ5		MOTOROLA 1/4M2.4AZ5
CR14	220019	DIODE SILICO ZENER	1N752A		MOTOROLA 1N752A
CR15	220019	DIODE SILICO ZENER	1N752A		MOTOROLA 1N752A
CR16	220030	DIODE SILICO ZENER	1/4M2.4AZ5		MOTOROLA 1/4M2.4AZ5
CR17	210004	DIODE SILICO	SD4		DIODES IN SD4
CR18	210004	DIODE SILICO	SD4		DIODES IN SD4
CR19	210004	DIODE SILICO	SD4		DIODES IN SD4
CR20	210004	DIODE SILICO	SD4		DIODES IN SD4
CR21	210004	DIODE SILICO	SD4		DIODES IN SD4
CR22	210004	DIODE SILICO	SD4		DIODES IN SD4
CR23	210004	DIODE SILICO	SD4		DIODES IN SD4
CR24	210004	DIODE SILICO	SD4		DIODES IN SD4
CR25	220016	DIODE SILICO ZENER	1N964B		MOTOROLA 1N964B
CR26	220016	DIODE SILICO ZENER	1N964B		MOTOROLA 1N964B
CR27	211083	DIODE SILICO	018	1	DANA 211083
CR28	211083	DIODE SILICO	018	1	DANA 211083
CR29	220019	DIODE SILICO ZENER	1N752A		MOTOROLA 1N752A
CR30	220019	DIODE SILICO ZENER	1N752A		MOTOROLA 1N752A
CR31	220030	DIODE SILICO ZENER	1/4M2.4AZ5		MOTOROLA 1/4M2.4AZ5
CR32	220030	DIODE SILICO ZENER	1/4M2.4AZ5		MOTOROLA 1/4M2.4AZ5
CR33	211083	DIODE SILICO	018	1	DANA 211083
CR34	211083	DIODE SILICO	018	1	DANA 211083
CR35	211083	DIODE SILICO	018	1	DANA 211083
CR36	220030	DIODE SILICO ZENER	1/4M2.4AZ5		MOTOROLA 1/4M2.4AZ5
CR37	211083	DIODE SILICO	018	1	DANA 211083
CR38	211083	DIODE SILICO	018	1	DANA 211083

PARTS LIST

ASSEMBLY 402944 **P C BOARD ASSY. MODEL 2860 OPT V5**

REF. DESIG.	PART NO.	DESCRIPTION						
CR39	220030	DIODE SILICO ZENER 1/4M2.4AZ5					MOTOROLA	1/4M2.4AZ5
CR40	211083	DIODE SILICO	018			1	DANA	211083
CR41	220030	DIODE SILICO ZENER 1/4M2.4AZ5					MOTOROLA	1/4M2.4AZ5
CR42	211083	DIODE SILICO	018			1	DANA	211083
CR43	211083	DIODE SILICO	018			1	DANA	211083
CR44	211083	DIODE SILICO	018			1	DANA	211083
CR45	211083	DIODE SILICO	018			1	DANA	211083
CR46	220030	DIODE SILICO ZENER 1/4M2.4AZ5					MOTOROLA	1/4M2.4AZ5
CR47	220030	DIODE SILICO ZENER 1/4M2.4AZ5					MOTOROLA	1/4M2.4AZ5
C01	121473	CAP	MYLAR	.0015 MFD	100 V	10%1	CDE	WMF1S47
C02	100012	CAP	CERAM	33 PFD	500 V	10%	AEROVOX	TCD-N750
C03	101174	CAP	CERAM	.001 MFD	500 V	10%1	AEROVOX	SCD3X5F
C04	100012	CAP	CERAM	33 PFD	500 V	10%	AEROVOX	TCD-N750
C05	101175	CAP	CERAM	220 PFD	500 V	10%1	AEROVOX	SCD1X5F
C07	101641	CAP	CERAM	470 PFD	500 V	10%1	AEROVOX	SCD1X5F
C10	110061	CAP	ELECT	100 MFD	50 V		SPRAGUE	39D107G050EJ4
C11	110061	CAP	ELECT	100 MFD	50 V		SPRAGUE	39D107G050EJ4
C12	121093	CAP	MYLAR	.047 MFD	100 V	10%1	CDE	WMF1S47
C13	120131	CAP	MYLAR	.015 MFD	100 V	5%	IMB	XT2B153J
C15	121468	CAP	MYLAR	.022 MFD	100 V	10%1	CDE	WMF1S22
C17	101174	CAP	CERAM	.001 MFD	500 V	10%1	AEROVOX	SCD3X5F
C18	110062	CAP	ELECT	500 MFD	50 V		SPRAGUE	39D507G050L4
C19	110062	CAP	ELECT	500 MFD	50 V		SPRAGUE	39D507G050L4
C21	101642	CAP	CERAM	150 PFD	500 V	10%1	AEROVOX	SCD2X5F
C22	100018	CAP	CERAM	120 PFD	1000 V	10%	AEROVOX	ETCD
C23	100010	CAP	CERAM	68 PFD	500 V	10%	AERVOX	TCD-N750
C24	101174	CAP	CERAM	.001 MFD	500 V	10%1	AEROVOX	SCD3X5F
C25	101174	CAP	CERAM	.001 MFD	500 V	10%1	AEROVOX	SCD3X5F
C26	101174	CAP	CERAM	.001 MFD	500 V	10%1	AEROVOX	SCD3X5F
C27	101174	CAP	CERAM	.001 MFD	500 V	10%1	AEROVOX	SCD3X5F
C28	120129	CAP	MYLAR	1.5 MFD	100 V	5%	IMB	XT2B155J
C29	120130	CAP	MYLAR	.15 MFD	100 V	5%	IMB	XT2B154J
C30	120131	CAP	MYLAR	.015 MFD	100 V	5%	IMB	XT2B153J
C31	130051	CAP	GLASS	.0015 MFD		5%	ELMENCO	CM-20-E-152J
C32	130056	CAP	GLASS	200 PFD		5%	OHMITE	CM15E201J
C33	120129	CAP	MYLAR	1.5 MFD	100 V	5%	IMB	XT2B155J
C34	120130	CAP	MYLAR	.15 MFD	100 V	5%	IMB	XT2B154J
C35	120131	CAP	MYLAR	.015 MFD	100 V	5%	IMB	XT2B153J

PARTS LIST

ASSEMBLY 402944 **P C BOARD ASSY. MODEL 2860 OPT V5**

REF. DESIG.	PART NO.	DESCRIPTION						
C36	130051	CAP	GLASS	.0015 MFD		5%	ELMENCO	CM-20-E-152J
C37	130056	CAP	GLASS	200 PFD		5%	OHMITE	CM15E201J
C38	120129	CAP	MYLAR	1.5 MFD	100 V	5%	IMB	XT2B155J
C39	120130	CAP	MYLAR	.15 MFD	100 V	5%	IMB	XT2B154J
C40	120131	CAP	MYLAR	.015 MFD	100 V	5%	IMB	XT2B153J
C41	130051	CAP	GLASS	.0015 MFD		5%	ELMENCO	CM-20-E-152J
C42	130057	CAP	GLASS	560 PFD		5%	OHMITE	CM15E561J
C43	101175	CAP	CERAM	220 PFD	500 V	10%1	AEROVOX	SCD1X5F
C44	100005	CAP	CERAM	22 PFD	500 V	10%	AEROVOX	TCD-N750
C45	100012	CAP	CERAM	33 PFD	500 V	10%	AEROVOX	TCD-N750
C46	101145	CAP	CERAM	100 PFD	500 V	10%1	AEROVOX	SCD1X5F
C47	101174	CAP	CERAM	.001 MFD	500 V	10%1	AEROVOX	SCD3X5F
C48	100018	CAP	CERAM	120 PFD	1000 V	10%	AEROVOX	ETCD
C49	101182	CAP	CERAM	47 PFD	500 V	10%1	AEROVOX	TCD-N750
C50	101174	CAP	CERAM	.001 MFD	500 V	10%1	AEROVOX	SCD3X5F
C51	101099	CAP	CERAM	680 PFD	500 V	10%1	AEROVOX	SCD2X5F
C53	101174	CAP	CERAM	.001 MFD	500 V	10%1	AEROVOX	SCD3X5F
C54	101174	CAP	CERAM	.001 MFD	500 V	10%1	AEROVOX	SCD3X5F
C55	101174	CAP	CERAM	.001 MFD	500 V	10%1	AEROVOX	SCD3X5F
C56	101098	CAP	CERAM	330 PFD	500 V	10%1	AEROVOX	SCD1X5F
C57	101174	CAP	CERAM	.001 MFD	500 V	10%1	AEROVOX	SCD3X5F
L01	310034	CHOKE		200 MH			MILLER	9210-90
L02	310034	CHOKE		200 MH			MILLER	9210-90
L03	402470	**CHOKE OUTPUT 30 MH**					**DANA**	402470
L04	310033	CHOKE		100 MH			MILLER	9210-76
L05	310033	CHOKE		100 MH			MILLER	9210-76
L06	310033	CHOKE		100 MH			MILLER	9210-76
Q01	201084	TRANS	GERMAN PNP	2N1304		1	TI	2N1304
Q02	402715	ASSY		FSV 2860			DANA	402715
Q03	201285	TRANS	DUAL NPN	016S			DANA	201285
Q04	200043	TRANS	SILICO NPN	2N3565			FAIRCHILD	2N3565
Q05	200043	TRANS	SILICO NPN	2N3565			FAIRCHILD	2N3565
Q06	200043	TRANS	SILICO NPN	2N3565			FAIRCHILD	2N3565
Q07	200011	TRANS	SILICO PNP	009			DANA	200011
Q08	200035	TRANS	SILICO NPN	014			DANA	200035
Q09	200035	TRANS	SILICO NPN	014			DANA	200035
Q10	200011	TRANS	SILICO PNP	009			DANA	200011
Q11	200011	TRANS	SILICO PNP	009			DANA	200011

PARTS LIST

ASSEMBLY 402944 **P C BOARD ASSY. MODEL 2860 OPT V5**

REF. DESIG.	PART NO.	DESCRIPTION					
Q12	200035	TRANS SILICO NPN	014		DANA	200035	
Q13	200072	TRANS SILICO DUAL FSV			DANA	200072	
Q14	200072	TRANS SILICO DUAL FSV			DANA	200072	
Q15	200072	TRANS SILICO DUAL FSV			DANA	200072	
Q16	200072	TRANS SILICO DUAL FSV			DANA	200072	
Q17	201084	TRANS GERMAN PNP	2N1304	1	TI	2N1304	
Q18	200022	TRANS SILICO PNP	012		DANA	200022	
Q19	200043	TRANS SILICO NPN	2N3565		FAIRCHILD	2N3565	
Q20	200043	TRANS SILICO NPN	2N3565		FAIRCHILD	2N3565	
Q21	200040	TRANS SILICO NPN	016		DANA	200040	
Q22	200043	TRANS SILICO NPN	2N3565		FAIRCHILD	2N3565	
Q23	200022	TRANS SILICO PNP	012		DANA	200022	
Q24	200011	TRANS SILICO PNP	009		DANA	200011	
Q25	200035	TRANS SILICO NPN	014		DANA	200035	
Q26	200037	TRANS SILICO NPN	2N3646		FAIRCHILD	2N3646	
Q27	200037	TRANS SILICO NPN	2N3646		FAIRCHILD	2N3646	
Q28	200074	TRANS SILICO DUAL FSV			DANA	200074	
Q29	200074	TRANS SILICO DUAL FSV			DANA	200074	
Q30	200043	TRANS SILICO NPN	2N3565		FAIRCHILD	2N3565	
Q31	200043	TRANS SILICO NPN	2N3565		FAIRCHILD	2N3565	
Q32	200043	TRANS SILICO NPN	2N3565		FAIRCHILD	2N3565	
Q33	200022	TRANS SILICO PNP	012		DANA	200022	
Q34	200043	TRANS SILICO NPN	2N3565		FAIRCHILD	2N3565	
Q35	200043	TRANS SILICO NPN	2N3565		FAIRCHILD	2N3565	
Q36	200040	TRANS SILICO NPN	016		DANA	200040	
Q37	200022	TRANS SILICO PNP	012		DANA	200022	
Q38	200043	TRANS SILICO NPN	2N3565		FAIRCHILD	2N3565	
Q39	200043	TRANS SILICO NPN	2N3565		FAIRCHILD	2N3565	
Q40	200043	TRANS SILICO NPN	2N3565		FAIRCHILD	2N3565	
Q41	200011	TRANS SILICO PNP	009		DANA	200011	
Q42	200035	TRANS SILICO NPN	014		DANA	200035	
Q43	200035	TRANS SILICO NPN	014		DANA	200035	
Q44	200035	TRANS SILICO NPN	014		DANA	200035	
Q45	200011	TRANS SILICO PNP	009		DANA	200011	
Q46	200011	TRANS SILICO PNP	009		DANA	200011	
Q47	200043	TRANS SILICO NPN	2N3565		FAIRCHILD	2N3565	
Q48	200043	TRANS SILICO NPN	2N3565		FAIRCHILD	2N3565	

PARTS LIST

ASSEMBLY 402944 **P C BOARD ASSY. MODEL 2860 OPT V5**

REF. DESIG.	PART NO.	DESCRIPTION							
R01	020386	RES	WW	10 K	.1%	1/8 W	JORDAN	J11	
R02	020436	RES	WW	5 K	.01%		JORDAN	J11	
R03	020435	RES	WW	2 K	.01%		JORDAN	J11	
R04	020434	RES	WW	1 K	.01%		JORDAN	J11	
R05	020433	RES	WW	500 OHM	.01%		JORDAN	J11	
R06	020432	RES	WW	200 OHM	.01%		JORDAN	J11	
R07	020431	RES	WW	100 OHM	.01%		JORDAN	J11	
R08	020430	RES	WW	50 OHM	.01%		JORDAN	J11	
R09	020429	RES	WW	20 OHM	.01%		JORDAN	J11	
R10	020428	RES	WW	10 OHM	.01%		JORDAN	J11	
R11	010336	RES	METAL	806 K	1%		CORNING	RN60D9083F	
R12	010336	RES	METAL	806 K	1%		CORNING	RN60D9083F	
R13	040092	RES	VARI	20 K			SPECTRO	50-3-1-203	
R14	010112	RES	METAL	5.36 K	1%	1/4 W1	ELECTRA	RN60D5361F	
R15	010120	RES	METAL	68.1 K	1%	1/4 W	ELECTRA	RN60D6812F	
R16	040093	RES	VARI	500 OHM			SPECTRO	50-3-1-501	
R17	402715	ASSY		FSV 2860			DANA	402715	
R18	402715	ASSY		FSV 2860			DANA	402715	
R19	010122	RES	METAL	28.7 K	1%	1/4 W	ELECTRA	RN60D2872F	
R20	010259	RES	METAL	1 K	1%	1/4 W	ELECTRA	RN60C1001F	
R21	000102	RES	CARBON	1 K	5%	1/4 W1	OHMITE	RC07GF102J	
R22	000302	RES	CARBON	3 K	5%	1/4 W1	OHMITE	RC07GF302J	
R23	000134	RES	CARBON	130 K	5%	1/4 W	OHMITE	RC07GF134J	
R24	000134	RES	CARBON	130 K	5%	1/4 W	OHMITE	RC07GF134J	
R25	010022	RES	METAL	46.4 K	1%	1/4 W	ELECTRA	RN60D4642F	
R26	000183	RES	CARBON	18 K	5%	1/4 W1	OHMITE	RC07GF183J	
R27	000153	RES	CARBON	15 K	5%	1/4 W1	OHMITE	RC07GF153J	
R28	000621	RES	CARBON	620 OHM	5%	1/4 W1	OHMITE	RC07GF621J	
R29	000101	RES	CARBON	100 OHM	5%	1/4 W1	OHMITE	RC07GF101J	
R30	000331	RES	CARBON	330 OHM	5%	1/4 W1	OHMITE	RC07GF331J	
R31	000182	RES	CARBON	1.8 K	5%	1/4 W1	OHMITE	RC07GF182J	
R32	000820	RES	CARBON	82 OHM	5%	1/4 W	OHMITE	RC07GF820J	
R33	000510	RES	CARBON	51 OHM	5%	1/4 W1	OHMITE	RC07GF510J	
R34	000510	RES	CARBON	51 OHM	5%	1/4 W1	OHMITE	RC07GF510J	
R35	000104	RES	CARBON	100 K	5%	1/4 W1	OHMITE	RC07GF104J	
R36	000104	RES	CARBON	100 K	5%	1/4 W1	OHMITE	RC07GF104J	
R37	001192	RES	CARBON	9.1 K	5%	1/2 W	OHMITE	RC20GF912J	
R38	000331	RES	CARBON	330 OHM	5%	1/4 W1	OHMITE	RC07GF331J	

PARTS LIST

ASSEMBLY 402944 **P C BOARD ASSY. MODEL 2860 OPT V5**

REF. DESIG.	PART NO.	DESCRIPTION							
R39	000112	RES	CARBON	1.1 K	5%	1/4 W		OHMITE	RC07GF112J
R40	000820	RES	CARBON	82 OHM	5%	1/4 W		OHMITE	RC07GF820J
R42	000221	RES	CARBON	220 OHM	5%	1/4 W1		OHMITE	RC07GF221J
R43	000100	RES	CARBON	10 OHM	5%	1/4 W1		OHMITE	RC07GF100J
R44	000100	RES	CARBON	10 OHM	5%	1/4 W1		OHMITE	RC07GF100J
R45	000431	RES	CARBON	430 OHM	5%	1/4 W1		OHMITE	RC07GF431J
R46	000221	RES	CARBON	220 OHM	5%	1/4 W1		OHMITE	RC07GF221J
R47	000101	RES	CARBON	100 OHM	5%	1/4 W1		OHMITE	RC07GF101J
R48	402715	ASSY		FSV 2860				DANA	402715
R49	000431	RES	CARBON	430 OHM	5%	1/4 W1		OHMITE	RC07GF431J
R50	000472	RES	CARBON	4.7 K	5%	1/4 W1		OHMITE	RC07GF472J
R51	000182	RES	CARBON	1.8 K	5%	1/4 W1		OHMITE	RC07GF182J
R53	020386	RES	WW	10 K	.1%	1/8 W		JORDAN	J11
R54	040108	RES	VARI	50 OHM				SPECTROL	50-3
R55	040103	RES	VARI	20 K	5%			IRC	
R56	000102	RES	CARBON	1 K	5%	1/4 W1		OHMITE	RC07GF102J
R57	010158	RES	METAL	200 K	1%	1/4 W1		ELECTRA	RN60D2003F
R58	000201	RES	CARBON	200 OHM	5%	1/4 W1		OHMITE	RC07GF201J
R59	000202	RES	CARBON	2 K	5%	1/4 W1		OHMITE	RC07GF202J
R60	040040	RES	VARI	20 K	10%	1/4 W		BOURNS	271-1-203 M
R61	000152	RES	CARBON	1.5 K	5%	1/4 W1		OHMITE	RC07GF152J
R62	000221	RES	CARBON	220 OHM	5%	1/4 W1		OHMITE	RC07GF221J
R63	001102	RES	CARBON	9.1 K	5%	1/2 W		OHMITE	RC20GF912J
R64	000362	RES	CARBON	3.6 K	5%	1/4 W1		OHMITE	RC07GF362J
R66	000361	RES	CARBON	360 OHM	5%	1/4 W		OHMITE	RC07GF361J
R67	040092	RES	VARI	20 K				SPECTRO	50-3-1-203
R68	010075	RES	METAL	71.5 K	1%	1/4 W		ELECTRA	RN60D7152F
R69	010075	RES	METAL	71.5 K	1%	1/4 W		ELECTRA	RN60D7152F
R70	010077	RES	METAL	80.6 K	1%	1/4 W		ELECTRA	RN60D8062F
R71	010060	RES	METAL	10 K	1%	1/4 W		ELECTRA	RN60D1002F
R72	000361	RES	CARBON	360 OHM	5%	1/4 W		OHMITE	RC07GF361J
R73	000512	RES	CARBON	5.1 K	5%	1/4 W1		OHMITE	RC07GF512J
R74	000301	RES	CARBON	300 OHM	5%	1/4 W		OHMITE	RC07GF301J
R77	000201	RES	CARBON	200 OHM	5%	1/4 W1		OHMITE	RC07GF201J
R78	001706	RES	CARBON	510 OHM	5%	1/2 W1		OHMITE	RC20GF511J
R79	000122	RES	CARBON	1.2 K	5%	1/4 W1		OHMITE	RC07GF122J
R80	000151	RES	CARBON	150 OHM	5%	1/4 W1		OHMITE	RC07GF151J

PARTS LIST

ASSEMBLY 402944 **P C BOARD ASSY. MODEL 2860 OPT V5**

REF. DESIG.	PART NO.	DESCRIPTION						
R81	000201	RES	CARBON	200 OHM	5%	1/4 W1	OHMITE	RC07GF201J
R82	000201	RES	CARBON	200 OHM	5%	1/4 W1	OHMITE	RC07GF201J
R83	000122	RES	CARBON	1.2 K	5%	1/4 W1	OHMITE	RC07GF122J
R84	000122	RES	CARBON	1.2 K	5%	1/4 W1	OHMITE	RC07GF122J
R85	000151	RES	CARBON	150 OHM	5%	1/4 W1	OHMITE	RC07GF151J
R86	010211	RES	METAL	4.42 K	1%		CORNING	RN60D
R87	010324	RES	METAL	10.7 K	1%		CORNING	RN60D1072F
R88	000822	RES	CARBON	8.2 K	5%	1/4 W1	OHMITE	RC07GF822J
R89	000202	RES	CARBON	2 K	5%	1/4 W1	OHMITE	RC07GF202J
R90	000223	RES	CARBON	22 K	5%	1/4 W	OHMITE	RC07GF223J
R91	010020	RES	METAL	4.99 K	1%	1/4 W	ELECTRA	RN60D4991F
R92	000241	RES	CARBON	240 OHM	5%	1/4 W1	OHMITE	RC07GF241J
R93	010085	RES	METAL	4.53 K	1%	1/4 W	ELECTRA	RN60D4531F
R94	010112	RES	METAL	5.36 K	1%	1/4 W1	ELECTRA	RN60D5361F
R95	000511	RES	CARBON	510 OHM	5%	1/4 W1	OHMITE	RC07GF511J
R96	000512	RES	CARBON	5.1 K	5%	1/4 W1	OHMITE	RC07GF512J
R97	010075	RES	METAL	71.5 K	1%	1/4 W	ELECTRA	RN60D7152F
R98	010075	RES	METAL	71.5 K	1%	1/4 W	ELECTRA	RN60D7152F
R99	000163	RES	CARBON	16 K	5%	1/4 W1	OHMITE	RC07GF163J
R100	000202	RES	CARBON	2 K	5%	1/4 W1	OHMITE	RC07GF202J
R101	000512	RES	CARBON	5.1 K	5%	1/4 W1	OHMITE	RC07GF512J
R102	010113	RES	METAL	15 K	1%	1/4 W	ELECTRA	RN60D1502F
R103	000511	RES	CARBON	510 OHM	5%	1/4 W1	OHMITE	RC07GF511J
R104	001102	RES	CARBON	9.1 K	5%	1/2 W	OHMITE	RC20GF912J
R105	000563	RES	CARBON	56 K	5%	1/4 W	OHMITE	RC07GF563J
R106	000161	RES	CARBON	160 OHM	5%	1/4 W	OHMITE	RC07GF161J
R107	000241	RES	CARBON	240 OHM	5%	1/4 W1	OHMITE	RC07GF241J
R108	001751	RES	CARBON	33 OHM	5%	1/2 W	OHMITE	RC20GF330J
R109	001748	RES	CARBON	16 OHM	5%	1/2 W	OHMITE	RC20GF160J
R110	001748	RES	CARBON	16 OHM	5%	1/2 W	OHMITE	RC20GF160J
R111	001748	RES	CARBON	16 OHM	5%	1/2 W	OHMITE	RC20GF160J
R112	001748	RES	CARBON	16 OHM	5%	1/2 W	OHMITE	RC20GF160J
R113	001751	RES	CARBON	33 OHM	5%	1/2 W	OHMITE	RC20GF330J
R114	040052	RES	VARI	50 OHM	10%	1.5 W	CTS	110
R115	000100	RES	CARBON	10 OHM	5%	1/4 W1	OHMITE	RC07GF100J
R116	020381	RES	WW	1 K	3%	3 W	CF	M18
R117	040098	RES	VARI	20 K	10%		BECKMAN	62PR20K
R118	000102	RES	CARBON	1 K	5%	1/4 W1	OHMITE	RC07GF102J

PARTS LIST

ASSEMBLY 402944 **P C BOARD ASSY. MODEL 2860 OPT V5**

REF. DESIG.	PART NO.	DESCRIPTION								
R119	000161	RES	CARBON	160	OHM	5%	1/4 W		OHMITE	RC07GF161J
R120	402715	ASSY			FSV 2860				DANA	402715

Warranty

It is the practice of Dana Laboratories, Incorporated, to manufacture only products of a quality that will merit customer satisfaction. The company recognizes that customer satisfaction is achieved, not only by delivering products meeting advertised performance specifications and having a high level of reliability, but also by honestly and efficiently fulfilling their warranty obligations as set forth below.

Dana Laboratories, Inc., agrees to correct, either by repair or replacement, any defect of material or workmanship in Dana-manufactured units or components which develop within one year after delivery of the equipment to the original purchaser — provided that the equipment has been subjected only to normal and proper use.

In the event of failure of any component delivered with Dana equipment, but not manufactured by Dana Laboratories, assistance will be given the customer in obtaining, from the original manufacturer, reasonable adjustment under that manufacturer's warranty.

Any item claimed to be defective during the warranty period must be returned to Dana Laboratories, Inc., with transportation charges prepaid. The item will be repaired and returned to the purchaser with return transportation prepaid by Dana unless, of course, the item is found not to be defective or found to be damaged by misuse — in which case it will be returned to the purchaser with repair and transportation billed collect.

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